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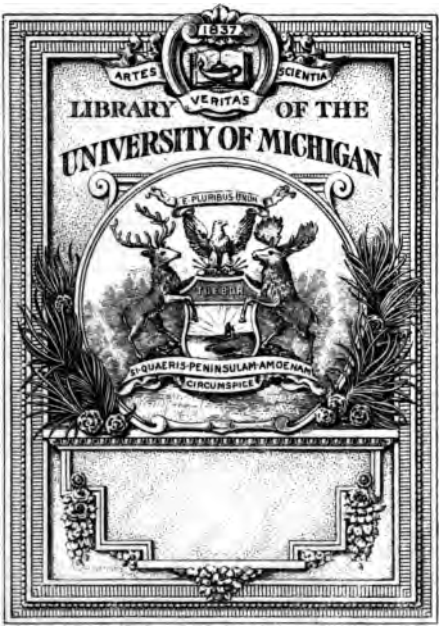
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SPECIAL METHOD

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GEOGRAPHY

FOR

THIRD AND FOURTH GRADES

BY

CHARLES A. McMURRY, PH.D.

THIRD EDITION

REVISED AND MUCH ENLARGED.

1897

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PREFACE.

This little book is designed to outline and illustrate a plan for the study of geography in third and fourth grades.

After a closer survey of home objects in third grade, it lays the scene of operations for the fourth grade in the Mississippi Valley. A series of *type studies* of great fullness and detail is worked out, with the aim of making geography thoroughly instructive and stimulating to children.

The "Pioneer History Stories of the Mississippi Valley" are used in the same grade and cover exactly the same area as the geography topics, so that the relation between history and geography is intimate and many-sided.

The natural science topics treated in the grade are also largely suggested by the geography and history. This enables us, therefore, to illustrate more fully the plan of concentration of studies discussed in the "General Method."

This book is one of a series of Special Methods, treating of the selection and quality of the best materials furnished by the separate studies, and points out the particular application of general principles to these materials. The others are as follows:

Special Method in *Literature* and *History*, especially the oral treatment of stories in primary and intermediate grades. The history course for grammar grades is also discussed and outlined.

Special Method in *Reading*, a discussion of the quality, culture-value, and method of using the best classics as reading exercises. A full list of one hundred and forty-six choice books, arranged according to grades, is given.

Special Method in *Natural Science*. A historical and critical discussion of the leading ideas involved in science teaching in common schools is followed by illustrations of the treatment of science topics, by lists of books of reference in science studies and by a series of science topics for the grades.

Other Special Methods in Language, Arithmetic, Music, and Drawing may be issued later.

A third series of books for the use of children as well as teachers, has been partly worked out, which gives in full, rounded form some of the choicest materials which are much needed to enrich the somewhat dry text-book lore of our schools. Thus far the series is worked out as follows:

Classic Stories for the Little Ones by Mrs. Lida B. McMurry. They are used for oral narrative in first grade and as a reading book in second grade.

Robinson Crusoe for Boys and Girls, by Mrs. Lida B McMurry and Mrs. Mary Hall Husted, for oral work in second grade and used as a reading book in third grade.

Tales of Troy, by Dr. Charles De Garmo. A classic story for Boys and Girls in third and fourth grades.

Pioneer History Stories, of the Mississippi Valley, by C. A. McMurry, for fourth and fifth grades.

Pioneer Explorers on Land and Sea, by C. A. McMurry, for fifth and sixth grades.

A *Course of Study* for the eight grades of the common school is being worked out in a separate volume by the same author. For price-list see end of this book. CHARLES A. MCMURRY,

Normal, Ill.

State Normal University, August 1, 1895.

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CHAPTER I.

Home Geography.

Home geography in the third grade has to do with one's native town and neighborhood, and with the varied objects of study they supply.

The work will consist in the main of excursions and later of discussions of these in the class,—excursions into the home neighborhood to secure a close and accurate view of many objects and occupations, and discussions in class to bring out more fully their meaning and relations.

There are seven principal topics that may be thus experimentally studied in home geography:

1. Food products, and occupations connected with them.
2. Building materials and related trades.
3. Clothing materials used, manufacture, etc.
4. Local commerce, roads, bridges, railroads.
5. Local surface features. Streams, hills, woods, etc.
6. Town and county government. Court-house, etc.
7. Climate and seasons. Sun, wind, storms, heat.

These seven topics cover a broad and varied field of home observation and make up the phys-

ical environment which presses in from all sides through the senses. It may not be necessary to follow this outline in a fixed or unchanging order, but to consider the season, the neighborhood, the size of the class, and the local opportunities for excursions.

Many topics studied in the two preceding grades have paved the way for Home Geography. Robinson Crusoe has suggested many local interests. The science lessons have already led the children out upon short excursions. The fairy tales and myths have given vivid pictures of many home scenes. In the third grade itself, the natural science lessons and home geography supply a fitting counterpoise to the Greek myths and the story of the Seven Little Sisters. In the latter (the myths) the untamed fancy is given a pretty loose rein; in the former, common realities engage the interest and attention. And yet the two fields of experience are linked together by many close bands.

To those, therefore, who are interested in the problem of concentration of studies, the whole body of knowledge which we are now considering in third grade shows up not only a complex of closely related studies, but also a close adaptation to the interest and needs of children of this age.

We will enter upon a brief discussion of each of the seven topics previously mentioned.

1. *Food products.*—The spring season is a fit-

ting time to make a few excursions to the gardens, and perhaps still further, to the farms. The gardeners are busy with hot-beds, seeds, young plants, and the fresh-turned soil. At this season, also, many of the children may observe the work of plowing, transplanting, and cultivating in their own gardens, and report upon the same. In the fall, also, before and after the first frosts, they may again turn a closer attention to the products of the gardens, orchards, and fields. In the spring-time it may be well to select one or two characteristic vegetables for a full description of the planting and cultivation, as the cabbage-seed, hot-bed, transplanting, hoeing, storing, or covering-in for winter. In the same way one or two of the fruits may be examined and discussed; as, blackberries and grapes.

A catalogue should be made of the vegetables produced within a radius of several miles, as tomatoes, cabbages, turnips, onions, potatoes, tobacco, etc. Without going far from home, but keeping within the children's range of observation, we may form a long and varied list, and find instructive lessons, which will serve good purposes in future studies. With town children it is often necessary to take systematic lessons of this kind, else they will be ignorant of elementary ideas in agriculture, commerce, and surface.

The list of food products about our home may be increased by a list of the fruits, cultivated and

wild, found in our gardens, orchards, woods, and fields. We need to get definite knowledge of plants which yield berries and other small fruit, as well as kinds of apple trees, crabs, plums, cherries, haws, etc.

Besides the vegetables and fruits, what grains are raised on the farms near us? Take a grain like *wheat* and describe the succession of steps in preparing the ground, drilling, harvesting, threshing, milling, etc., till it is ready for final use.

The farmer's stock is an important part of his outfit, as horses, cattle, sheep, or swine. The relations of grain-raising to stock-raising, and the profits of the farmer in combining the two, are of interest. A description of the farmer's work in winter, spring, summer, and fall, may give some notion of the variety of his occupation. The tools, machines, barns, and sheds necessary to the farmer are noticed. It is worth while to observe when and how the farmer gets his grain and stock to market. The need of wagons roads, bridges, and markets is made apparent.

2. The second main topic, *building materials*, calls for an investigation of the things used in building our houses. Pine and hardwood, the varieties of stone used, brick, sand, lime, iron, glass, tin, lead, slate, paper, and paint. Besides observing the variety of uses to which these things are put, and the quality of the materials, it is well for us to visit a sawmill, a carpenter shop, a stone

quarry, a brick yard, a planing mill, a stone cutter's, a tinner's, a plumber's, and a lime kiln. It is especially desirable to observe the work upon a house in process of construction. A connected description of each of these places should be given by the children after observation. It is systematic school work. A few excursions to these places are necessary, children and teacher together. We observe, also, and describe the tools and machines used by the men in their different occupations or trades.

3. The third topic, *clothing*, will have to do with wool and leather, and any other raw materials, as furs, that are produced in our neighborhood; also, the home animals that yield leather, wool, and fur, also the tanneries, shoe shops, woolen mills, and any other local industry bearing on this subject. An explanation of the process of weaving by which the fleeces of wool are converted into woolen cloth or blankets, is quite practicable at this point. The same as to *tanning*. Secondly, we would discuss cotton, silk, linen, straw, and rubber goods which are brought from a distance, but are familiar in daily use. Our purpose, however, is not to discuss these topics exhaustively at this point.

Besides the occupations already mentioned, nearly every city or town has some special *local industries* worthy of mention, such as wagon works, paper mills, shoe factory, glass works, machine

shops, foundry, basket factory, etc. It is well also, to call to mind the great *variety of occupations* in any town besides those already named, as grocers, bankers, dry goods merchants, doctors, engineers, wholesale dealers, blacksmiths, watchmakers, tailors, etc.

4. Our fourth topic, *roads, bridges, and local commerce*, stands in close relation to the previously discussed occupations. The chief wagon roads by which the farmers, gardeners, dairymen, quarrymen, and wood cutters bring their produce to market, are not only remembered and described by the children, but these with a few of the main streets of the town form the nucleus for a map of the neighborhood. Farmers and others bring their loads into town for sale, and with the profits thus gained buy and carry back with them such things as they must have from the city. In this way the idea of a town as a trade center for receiving the raw products of the surrounding country, and in turn distributing groceries, clothing, tools, and many other things to the farmers, is made clear. The chief railroad lines to the neighboring villages or towns should find a place on our map as it is gradually outlined. These furnish ideas of commerce on a larger scale, and between villages and a larger town. If our town lies on a navigable river or canal, a knowledge of the boats and their cargoes is of importance.

5. The fifth topic that requires a detailed treat-

ment is *local surface features.* Some may prefer to put this subject earlier in home geography, and to this there is no objection if the season of the year is favorable. If any stream flows near the home, all the leading facts connected with such a water-course should be observed and described, for example the current itself with its shallows, rapids, and deeper places; the sand bars, bottom lands, and bluffs, sloping and tree-covered or steep and rocky; the old channels and lagoons; the river as seen at different seasons, floods, high and low water, uses of the river in winter and summer, the river commerce, if it is navigable; the whole river valley with its irregular course as seen from some commanding point. Then there are the smaller streams and valleys opening into the larger. Up these valleys roads are laid out into the uplands. In some places the bottom lands are rich and productive, in others sandy or flooded. Erosion or the wearing force of water can be clearly seen. Then there may be wooded slopes, brooks and springs, rocky cliffs, and picturesque outlooks, the regular layer of rocks, and the caves in the sandstones. Even along smaller streams many of the characteristic objects of a water course may be discussed. There are many other surface features which we may observe best near home. The idea of the forest and of the prairie may be distinctly formed, meadow and cultivated field, hill and mountain, valley and plain, ridge and water-

shed, island and lake, waterfall and mill stream, difference in soil and consequent differences in products. If we understood how much all future geography study depends upon this use of home materials, we certainly would not neglect them.

6. The sixth topic is *home government.* The town hall, the court house, and the officers there employed, furnish the best starting point. What duties have these people to perform? The mayor, the town council, the county judge, and county treasurer? What does the town council meet to discuss and decide? (water-works, streets, police, improvements, taxes, etc.) It is not the abstract but the concrete treatment of these subjects that children need. Beginning with the objects and persons we see, we are to interest them in these things still further.

7. Still a seventh topic of home geography is found in the observation of sun, moon, and stars, and seasons, the varying length of day and night, and the changing position of sun and moon. We forget that these grand object lessons, some of them the most beautiful and imposing, belong directly to the child's home and are a part of it. Such are a few of the more noticeable constellations, the clouds and storms, cold, heat, and rain and their effects, the sunsets. These ideas lie at the basis of mathematical geography and climate, just as some of the other topics contain the concrete elements of commerce, surface, and government.

A brief survey of the topics thus far suggested in outline will show that the children by personal inspection and experience have become acquainted with the common staple necessities and leading occupations of men, as farming, mining, manufacturing, trade, and with many lesser ones; that the idea of commerce and a trade center has become clear. Definite ideas also have been formed as to a river, brook, hill, forest, prairie, field, lowland, valley, island, slope, watershed, etc. Clear notions of town and county government have been reached, while climate, the seasons, and the phenomena of the weather, have not only been seen, but closely observed. There is scarcely a topic in subsequent geographical study which does not find a sure, concrete footing in this preliminary work. If there is any value in careful, personal observation or in the principle of going from the known to the unknown, it is fully illustrated in the successive grades of geography study. The home constitutes the first great unit in this branch of work.

EXCURSIONS

It is difficult to see how a successful study of the home neighborhood can be carried on without excursions. A single excursion will often supply abundant materials for instructive discussion for two or three lessons. Any attempt to discuss the same topics, without the basis of real observation, which the trip supplies, will soon grow formal

and unattractive. There is much variety of surprising knowledge to be gained by stepping from the school-room directly into this great world of realities. The ignorance of most so-called intelligent people of many important things about home is matter for surprise. It is an extremely faulty training that allows us to pass by so many of these things without any desire or effort to understand them.

When we come to study the climate, surface, industries, products, and commerce of distant states and of foreign countries, our ability to understand and construct correct pictures is based upon the varied ideas of similar kind that we have gathered in vivid and real form from our home neighborhood: The imagination must be our chief helper in constructing geographical pictures after leaving home. But the imagination cannot construct pictures out of nothing any more than a builder can construct a house out of air. The imagination works with the materials of experience already gathered. It is not expected that we should gather all the experimental facts we may need, in third grade excursions. We can do but little more than open the door into life and its varied forms, but we can make a useful beginning.

Excursions with groups of school children need to be well planned. The teacher needs to know pretty clearly what are the chief objects

to be seen. It should be as definitely planned as a lesson. If possible the place would better be visited beforehand by the teacher. During the excursion it is often desirable to get the children together and direct their attention to certain objects or processes, then take them aside for question and inquiry.

After returning to school (the next day perhaps), the observation gathered upon the excursion should be related in class, explanations made, faulty notions corrected, and many ideas brought out more distinctly. Such a discussion may be as helpful as the excursion itself. Many ideas connected with the business or place may be brought home to their minds, which were not seen or noticed at the time, but which may be very important for the whole subject. If a factory is visited the kinds of materials used and where obtained may be brought up.

Drawing the objects, machines, or processes seen is an excellent means of making more vivid their observations. In visiting shops, factories, buildings, and even in nature, many objects will be more clearly formed in mind if the practice of drawing is frequently resorted to—not esthetic drawing, but mere sketching, diagramming, and picturing objects in a crude way. It may be well, also, in the drawing lesson proper, to take some of these objects for more accurate reproduction. But we had in mind not the drawing lesson proper, but

the sketching for help in understanding and remembering facts and objects.

There are many serious *difficulties* in the way of a general introduction of excursions:

1. It has not been the custom to make such excursions for purposes of instruction. It is generally supposed that children will pick up this kind of information without aid from teachers.

2. It is difficult to manage large classes out of doors. It is hard enough to keep children busy with good work in school. Get them outdoors and the burden is doubled. Children are more difficult to manage in the open air than in a school-room. They take liberties, etc. It is a real burden, oftentimes, to go upon an excursion with a large class of children. Over against this difficulty there is one considerable advantage. A teacher who wishes to know and understand her children, can oftentimes do it much better outdoors or upon a journey than in a school-room. They are more free to express themselves. Moreover, when the right spirit prevails, children and teacher come closer together and arrive at a better understanding and sympathy with each other when abroad. Even if a teacher can't get away with children more than once a term, it will be a new experience that will add much to the interest of school life.

3. There are dangers connected with visiting factories and workshops. Great precaution in

this respect is necessary. A single unfortunate accident would outbalance a great amount of good. A teacher should be very watchful to prevent any accidents. In mills and shops, where machinery is used, it is better not to take more than a dozen or fifteen children at a time, and to look out for their safety. Even in excursions where no danger is present, a teacher should be watchful and careful not to overexcite or overstrain the children. In climbing the stairs to get to the cupola of a large school, one little girl became timid and nervous and was taken back to the lower rooms at her request.

EXAMPLES OF EXCURSIONS.

TRIP TO A PLANING MILL IN BLOOMINGTON.

1. Preparation for the trip.
2. Trip by street car.
3. Visit to a planing mill:
   - *a.* The planing machine.
   - *b.* The circular saw or buzz saw.
   - *c.* The scroll saw.
   - *d.* The band saw.
   - *e.* The turning lathe.
   - *f.* Machine for making door panels.
   - *g.* The engine room. Bands. Shaft.
   - *h.* General view of store-house, lumber yard, etc.

1. *Preparation.*—Notice was given to the children that on the following day a trip would be

made to the planing mill, and they should get permission of their parents before going.

At 2:15 p. m. the next day, seventeen children out of a class of nineteen, set out, under the direction of the teacher. Taking a street car, they soon came within a block of the planing mill.

Before entering the mill the children were fully cautioned against touching the machinery or getting too close to wheels or bands. The teacher then inquired at the office of the mill to secure permission to go through the shop. The teacher then glanced into the mill to see where to begin the inspection of machines. It is necessary to keep the children together, to call their attention to the special points.

a. The first process observed was the planing of rough boards at the planing machine. The effect could be seen as the board came through smooth and bright on one side. But the process could not be seen, as the knives were covered up by the large pipe that carried away the chips or shavings.

b. A band saw was next examined as it stood motionless. The children, at first, fail to notice how the saw circles about the two wheels. The workman then applied the power and sawed out a number of brackets.

c. A scroll saw was also observed, both at rest and in motion. The up and down movement was seen and several pieces of scroll work turned out.

d. Several circular or buzz saws were examined in action as they sliced up inch and two-inch boards. They were also used in sawing up pieces of board of specified length.

e. A turning lathe was closely observed as the workman chiseled off a post for a porch. The skill and beauty of this work were surprising.

f. Three machines were also seen in motion as they mortised and turned out door panels.

Several other machines were not in operation and therefore were not more closely studied.

g. We all passed into the engine room to observe the belt which transfers the power from the engine to the main shaft that runs the whole length of the mill. After seeing this source of power we passed again into the main room to notice again how the wheels ranged along the main shaft are supplied with belts which carry the power to the different machines.

h. Passing out of the planing mill, we stopped for a brief review of the chief machines and operations observed. We also took a survey of the lumber yard, the great chimney, and the storehouse where the doors, sash, and other fine materials manufactured in the mill are stored.

In passing along the street we came to a long two-story brick livery stable in the process of construction. It was very wide, with a heavy framework of wooden timbers as interior support. This building gave an excellent chance to observe

two things. First, two rows of heavy posts, a foot in diameter, supporting two heavy beams extending through the length of the building. Upon these beams rested the foot-wide joists, whose other ends were built into the brick walls at the side. A better opportunity to see clearly the interior frame of a large building could hardly be found. Secondly, a single horse was being used, with a wheel and pulley, to lift loads of brick and mortar to the builders who were at work upon the second story. The upper and lower wheel could be distinctly seen, also the movement of the rope and load. This is not only a good typical illustration of the rope and pulley, but also of the idea of horse power, which is so often referred to.

When one is out upon excursions with children it is well to take advantage of such incidental object lessons as are thus offered. We might travel many miles without again meeting such an opportunity as was thus thrown in our way.

In the next geography lesson in the schoolroom the main objects which were seen upon this excursion were thoroughly discussed. It will be found that many things which were supposed to be clear to the boys and girls were not so. Many things, also, which were not clear, can be made so to the children. Sketches and diagrams were made both by teacher and pupils.

The whole time occupied by the excursion, from the time of taking the street car till we got

off at home, was two hours and twenty minutes. If it had been desirable the time could have been shortened to one hour and forty minutes.

The pine boards and different kinds of wood used in the planing mill were noticed, and attention called to the railroads which bring these materials from a distance. The relation of the planing mill to the work of contractors and carpenters in house building was discussed in the class.

TRIP TO THE CUPOLA OF THE NORMAL BUILDING.

1. View to the west.
2. View to the east.
3. View to the south.
4. View to the north.

In the cupola of the Normal School building, we are lifted above the tops of the highest trees in the campus and can look abroad over a wide area of what was once a prairie country. Looking first to the west, we see a characteristic farming country of the prairie region. There are groves of trees about the farm houses, and fields of different kinds, as corn, oats, and pasture. To the northwest lies a prairie with but few trees, rolling and stretching away for many miles. We can trace the main road westward, and as the eye follows it to the western horizon we see a line of black. It is the woods, about eight miles west of Normal. This natural forest stretches from the south along the western horizon for many miles.

Passing to the opposite side of the cupola, we look down upon the scattered village of Normal, in summer time so embowered in trees that few houses can be clearly seen. The whole town has become a grove of maples and elms, but when the leaves are fallen we can see the chief streets, the two railroads and the station at the junction, the stores, the big barns and wind mills, and to the northeast a mile away, the Soldiers' Orphans' Home. Beyond the town to the east, the road climbs some long hills as it rises to the higher prairie country beyond. To the east in this direction can be seen the nursery and the stock-yards.

Turning to the south, we have a city before us. Two miles away we can see ten or a dozen church spires, the court house, the Wesleyan, the smoking chimneys of the big car shops along the Chicago & Alton Railroad, the stove foundry to the southeast on the line of the Illinois Central. The tall water-tower of the Bloomington water-works is the highest object in the whole landscape. The line of the Chicago & Alton, and also of the Illinois Central, can be distinctly traced, as well as the street-car line between Normal and Bloomington. The culverts can also be seen where the little stream that drains the town of Normal passes under the railroad.

Turning our eyes out the north window, we again have a prairie country, sloping upward. There is a steady slope for three miles or more

from the north to Sugar creek. Beyond the creek toward Bloomington the road rises somewhat abruptly, leaving a perceptible valley between Normal and Bloomington.

It is necessary to discuss these matters closely with the children, so as to give their observations clearness and accuracy.

When we consider the variety of typical objects seen in such a view of the country as this, it proves its utility. Prairie, forest, cultivated fields, railroads, factories and shops, country roads, bridges, and the churches and buildings of a city, furnish important elementary pictures. A second lesson in class should give the children a chance for a full description and discussion of these objects.

With this survey of the surrounding country as a basis, the teacher and children should draw a map of the region observed, laying out the campus as a center, the chief wagon roads and railroads, and locating upon it the leading points of interest already discussed. This should be worked out on a fixed scale, taking some familiar half-mile or mile stretch as a standard of measurement.

VISIT TO A DWELLING HOUSE IN PROCESS OF CONSTRUCTION.

1. The cellar, basement-walls.
2. The framework.
3. The sheeting, weather-boarding, flooring, shingling.

4. Window-frames, doors, and casings.
5. Plastering, slaking lime.
6. Tinning, spouting, cistern.
7. Painting.
8. Chimneys, heating, ventilation.

In the spring or fall some dwelling is usually in process of construction within a block or two of the school. With a third grade class it is advisable to make perhaps three excursions of half or three quarters of an hour each to such a house in process of building.

When the foundation is just complete, or better still, while the masons are at work upon it, notice the depth and extent of the cellar, the materials and tools used, windows, and door frames. On the return from the first excursion describe the materials and work seen. Draw also the ground plan of the basement, using the foot or yard as a standard of measurement.

The second trip may be made when the framework is toward completion, so that the posts, joists, beams, and rafters may be seen and how they are mortised together and rested upon the brick foundation. Notice the joists of the second story; also the rafters of the roof and how fastened at the ridge and sides. The manner of setting in door-frames and window-casings may be seen.

A third trip may be made to observe the lathing, plastering, and interior finish. The slaking

of the lime and mixing with hair are also instructive in the preparations for plastering. Later we may observe the finer work of interior finish, painting, graining, papering, etc.

The materials and tools used in all the processes of building should be seen and understood. The preparation of materials at the carpenter shop, planing mill, and tin shop should be noticed. The different trades involved in building, as of masons, carpenters, tinners, plumbers, painters, contractors, and mill men, should be appreciated, each in its specialty.

Each excursion, of course, will be worked over in the school room, with such descriptions and drawings as are needed to bring out clearly the facts observed.

LIST OF POSSIBLE EXCURSIONS.

1. *House building.*—Materials, trades, tools.
2. *Gardens.*—In spring and fall. Tools, vegetables.
3. *Nursery.*—Fruit and shade trees; grafting.
4. *Feed-mill.*—Corn-sheller.
5. *Blacksmith* and wagon-maker.
6. *Tinner.*—Soldering, tools, machines.
7. *Grocery Store.*—Variety of home and foreign products.
8. *Shoemaker.*—Tools, kinds of leather.
9. Cupola of school house.—Slopes, towns, fields, etc.

10. *Miller's park.*—Trees, wild animals, creek.
11. *Planing mill.*—Machines, processes, products.
12. *Court House.*—Records; court-room.
13. *Grain elevator.*—Belts, pockets, bins, chutes.
14. *Cooper shop.*—Hoop poles, staves, tools.
15. *Wagon shop.*—Wood-work, iron-work.
16. *Foundry.*—Molds, filling the molds.
17. *Hot-house.*—Construction, heating, plants.
18. *Water-works.*—Engine, pipes, tower.
19. *Carpet-weaver.*—Threads, shuttle, frame.
20. *Printing office.*—Setting type, printing machine.
21. *A bakery.*—Kneading, the oven.
22. *A stone quarry.*—Drilling, blasting.
23. *Bridges.*—Wagon bridge and railroad bridge.
24. *Soldiers' monument.*—Park; history.
25. *Machine shops.*—Engines, cars.
26. *Flour mill.*—Water power or steam power.
27. *Brickyard.*—Making bricks; the kiln.
28. *Canning factory.*—Tomatoes, corn.
29. *A natural forest.*—Kinds of trees; location.
30. *Gas works.*—Coke, furnaces, tank.
31. *A dairy.*—Churn; cheese-making.
32. *Furniture Factory.*—Materials, machines.
33. *China store.*—Kinds of ware.
34. *Tannery.*—Vats, bark.
35. *Woolen-mill.*—Washing and picking, carding, spinning, weaving.
36. *Saw-mill.*—Logs, saws, stacking.

37. *A wind mill.*
38. *A hardware store.*—Farming machinery.
39. *A bluff or hill.*—Watershed, slopes.
40. *Stream.*—Banks, floods, erosion.

More than half of the above-named excursions have been made with classes by the author, for school purposes. This list may be considerably enlarged. In almost any village neighborhood it would not be difficult to find twenty places adapted to instructive excursions. But even if but a half dozen such trips can be made during the year, they will prove valuable in several ways.

The Earth as a Whole.

Besides the seven topics of the home environment, there should be, in the oral work of third grade, a discussion of *the world as a whole.*

Different sized globes may be used to bring out the idea of the earth as a sphere. The continents and oceans may be located, the hot regions of the equator and the cold polar regions described without entering into mathematical geography. North America should be examined a little more in detail, and our own home state located in its proper relation to the whole country. It seems to us better to leave out of third grade the discussion of the earth's motions, the causes of the seasons, latitude and longitude, and the general forms of contour and surface given even in our elementary geographies. We would also omit in

fourth grade any effort at a careful detailed study of a continent like North America, with drawing and modeling of its relief forms, etc.

The purpose of this study of the earth as a whole is to get a bird's-eye view of the earth and of our own position and relation to it, so that when we enter upon fourth grade study we are prepared to move out from the home with a clear knowledge of our bearings and a simple understanding of the whole earth upon which we live. It seems clear that only a few lessons need be given to this study of the earth as a whole, and that by far the greater part of the time in third grade may be put upon the study of home objects.

There are several reasons why children's horizon of geographical study in third grade should not be limited to the immediate home neighborhood. Even before entering school, they have heard of the earth as a big ball. The Robinson Crusoe story in second grade carries them across oceans and into new regions. The Seven Little Sisters, read in third grade, is an effort, in story form, to realize some of the characteristic features of the whole big earth. Finally, geographical study in every grade must be both analytic and synthetic. It must begin at home and work outwards gradually, and it must also grasp the earth as a whole and begin to analyze into parts. In our fourth grade plan we shall attempt to show that the fundamental movement should be from

the home outward; but it will be necessary, at intervals throughout the course of progress, to take broad surveys of the earth as a whole, of continents, oceans, and large areas. Such broad surveys are necessary to keep our bearings and to prevent a blind movement into unknown regions.

CHAPTER II.

Geography for the Fourth Grade.

In the fourth grade we desire children to become acquainted with the Mississippi valley.

Before entering upon the full discussion of this field of study we will state briefly the chief controlling ideas that are to guide us.

1. The principal movement is *from home outward.*—It is constructive or synthetic. Beginning with topics in the home state we advance into the surrounding states till the whole great valley has been compassed. It will be assumed that a few lessons have been previously given to the geography of the world as a whole, to the continents and oceans, and more particularly to North America and the United States. It is expected also that throughout the study of the Mississippi valley in fourth grade the children will have the map of North America and of the United States much before them, and will survey often the relations that bind different states, cities, etc., to the whole country and even to the world. But the essential burden of work will be laid upon a successive treatment of topics specially characteristic of the Mississippi valley.

2. A full treatment of twenty important *typical subjects.*—Instead of scattering our forces over a multitude of topics, all of more or less importance in this region, our plan is to concentrate attention upon a very few chosen topics, thus gaining time for an adequate and instructive treatment of them. Since they are *types*, the meaning attached to them will be found wide reaching. Incidental to them, it is believed that the important facts of geography will be acquired.

3. *Causal relations.*—The causal relations which bind together different geographical topics will be regarded as very significant, and as a key to a right understanding and interest.

4. *Comparison* as a means of discrimination.—After a typical subject has received a full discussion, a comparison of it along the lines of similarity and difference will show the extent of its application and bring out still other topics by contrast. Comparisons are the most fruitful reviews, stimulating thought along old and new lines.

5. The *oral treatment* of topics.—So far as possible an oral treatment of these topics is desirable. But since this is possible only to a limited extent under our present plans of teaching, the material furnished in books should be graphic and detailed, and time should be given to discussion.

6. *Relations of geography* to the other studies of the year.—It is assumed that an intimate relation

is kept up between the other studies of the third grade and geography. The history, reading, natural science, drawing, language lessons, and geography are mutually related and helpful to each other.

These six points will be discussed more fully after sufficient illustrative materials have been gathered to show their importance.

We shall now introduce four topics in detail to illustrate the ideas just outlined.

The Illinois River.

Through the central portion of Illinois, reaches the crooked valley of a river of considerable size. Its head waters are close to Lake Michigan, both on the south and on the west. The Indians and white men, who first explored this region, carried their boats across the portage at South Bend to the Kankakee, or at Chicago to the Des Plaines. It is five hundred miles long, and for two hundred and forty-five miles, or nearly half that distance, is regularly used by steamboats for commerce. At some seasons it is now possible to launch a canoe in the Des Plaines, not far from Chicago, and make a journey by water to the mouth of the Illinois. But while the general slope of the country is the same now as then, while the same hills and bluffs are seen along the streams, everything else appears greatly changed since the days of Marquette and La Salle. The valley of the

Des Plaines, a mile wide in places, is bordered with low hills, and as we move south toward Joliet, shows some curious sights. Along the east side canal-boats are seen gliding by, loaded with stone or grain, coal or lumber. Sometimes the boats are drawn by mules, and again a little steam engine is seen puffing in one end of the boat. From time to time the canal widens, and several canal-boats are seen lying at anchor just above a lock, through which the boats are let down to a lower level, if they are passing toward Joliet; but they may be as easily raised if the boat is headed for Chicago. The lock consists of heavy side walls of masonry, with stout, double doors at each end. The boat is let into the lock by opening the doors on one side. If it is headed down the canal the lower gates are then opened, or partly so, till the water glides out, leaving the water level in the lock the same as in the canal below. The water in the canal flows steadily from Chicago river towards Joliet, carrying much of the sewage of the city into the Illinois. Chicago river has been deepened by digging and dredging. As the upper end of the canal is still lower than the level of the river, the water flows from the river into the canal and thus draws a current from Lake Michigan. At the present time we may see where the work of excavating a much deeper and wider canal is going on, which is to serve both as a canal for large vessels, and as a

means of drainage to the city. The machines employed and the great heaps of earth and rock thrown out show how great this undertaking is. In many places this new drainage canal is excavated through solid rock thirty feet deep and 160 feet wide at the bottom. The whole cost of this canal is estimated at twenty-one millions of dollars. We soon discover that the old canal, as well as the new one, is dug for a long distance in the solid rock, which here lies close to the surface. In fact, for fifteen or twenty miles north of Joliet, the whole eastern side of the valley seems to be one long row of rock quarries, where the limestone strata, lying in regular layers, are quarried and blasted out, sawed, and placed upon canal-boats or railroad cars to be shipped to Chicago, where vast quantities are needed for the foundations of buildings. The Chicago & Alton railroad also runs up this valley with the low hills and quarries on one side and the canal and river on the other. Just before reaching Joliet, our attention is attracted by a large stone structure, which has the appearance of a grand old castle, with high walls and towers on the corners. It is the state penitentiary, where hundreds of criminals are kept, and the rock quarries not only furnish materials for its construction but also labor to many of the convicts who are employed in the quarries.

At Joliet we may see great steel works, blast furnaces, and mills, and at this place the canal is

carried across the river, by means of a dam, which raises the water to the level of the canal, so as to let the canal-boats pass across. From this place the canal follows the north bank of the Des Plaines and of the Illinois till at Peru it enters the river. About fifteen or twenty miles southwest of Joliet our boat glides from the Des Plaines into the Illinois River, which is formed by the union of the Kankakee and Des Plaines.

At most of the large towns upon the Kankakee and upon the Des Plaines we shall find dams in the river which are used to supply water power to mills and factories, as at Wilmington, Kankakee, and Joliet. The Fox River, also, which joins the Illinois from the north, has several large towns like Aurora and Elgin which have good water power. These smaller streams, therefore, while they are not large enough for steamboats, are still of much service both for drainage and for water power.

From the point where the two rivers unite to form the Illinois, the latter becomes an interesting river. The bluffs are high in places and partly wooded. The valley is broad and the river winds in many curves through the great trough which has been cut down into the level prairies by the floods of water that have swept through this channel in past ages. Geologists tell us that the waters of Lake Michigan once found their outlet to the Mississippi through the great trough of the Illinois

valley. The old channel connecting the lake with the river has been found south of Chicago but was choked up and filled long ago by gravel and drift.

As our boat glides along the current between the wooded bluffs toward La Salle, a number of interesting spots are passed. At Ottawa the Fox River comes in from the north, and over it the canal is carried on a stone bridge or aqueduct. It looks much like a stone railroad bridge with great, heavy stone arches to support the weight of water passing through the canal. All the streams that come down to the Illinois from the north pass under the canal in this way. The canal of course follows the level valley between the river and the bluffs. A railroad follows the same valley close to the canal and river. This broad valley is very favorable to commerce both by water and by rail. Swift-moving railroad trains and slow-moving canal-boats add much to the life of this region. Near Utica, on the north side of the river is the wide meadow where the great village of the Illinois Indians once stood, and near which Tonty tried to prevent a battle between the Iroquois and Illinois tribes. On the south side is the steep front of Starved Rock, on the top of which Tonty built Fort St. Louis. Afterward, according to tradition, the last of the Illinois were starved to death on the summit of this bluff. At its base flows the Illinois river, at the rear is a steep ascent, and the broad valley, seen from its

top, with the winding current of the Illinois, is very picturesque On the north side of the river is Buffalo Rock, which is also famous in early history.

A little west of Starved Rock the Vermilion River enters the Illinois valley from the south, itself coming through a deep, narrow valley, along which is found some picturesque scenery. Deer Park, which opens into this stream, is a narrow, rocky cañon, with steep sides sixty feet high, which are thick with woods, so that it is cool and shady even on hot summer days. At the upper end of the narrow, winding cañon, is a semicircle of steep rock over which a little stream tumbles and then flows down through the cañon. Deer Park is only a few miles from Starved Rock, and this whole region is picturesque and interesting to the tourist.

Just before reaching LaSalle, our boat passes under the high bridge of the Illinois Central railroad. At LaSalle are great zinc works, which can be seen from the river. At Peru, a few miles to the west, the Illinois and Michigan canal enters the river, after a journey of ninety-eight miles from Chicago. From this point on the river is deep enough for canal-boats and small steamers.

We may now abandon our canoe and take up comfortable quarters on a steamboat for the rest of the journey. Above this the river is too shallow for steamers in summer time. In fact, a dam

in the river at Henry, twenty miles below Peru, raises the water six or eight feet and deepens the current twenty miles up-stream as far as Peru. On the west side of the dam at Henry is a lock, which enables boats to pass by the dam. The dam and lock at Henry, by means of which the water is deepened above and boats allowed to pass through, belong to what is called the system of *slack-water navigation.*

Between Peru and Henry, the Illinois River makes a grand sweep to the south. The valley is very broad, two or three miles in places, and the bluffs sometimes two hundred feet high. The road leading from the prairies to the valley below follows some ravine, and must descend a long, steep hill before reaching the bottom-lands. The bottom-lands are often low and marshy, sometimes covered with swamp-growing trees. Some of the bottom-lands are above the water-level and make rich cornfields. The soil in many of these bottoms is very deep and rich (sometimes fifty feet), and very heavy crops are raised. But in wet seasons the crop may be wholly destroyed by the floods. Among the bottom-lands are found shallow bayous and lakes, which are ancient channels of the river, now cut off and partly filled up. In the season of duck-hunting, thousands of wild duck feed among the swamps and bayous, and the sound of the sportsman's gun may be heard at all hours of the day, echoing between distant bluffs of the valley.

Below Henry the river winds through a broad valley with lower and more sloping bluffs. After passing a number of wooded islands below Lacon the river widens into a long shallow lake which reaches to Peoria. Peoria, which is near the site of the old Indian village, lies upon a sloping plain which rises gradually a mile back from the river to the foot of high wooded bluffs. The big breweries, distilleries, and glucose factories, for which Peoria is noted, lie mostly near the bank of the river. The best business streets are a few blocks back from the river and higher up on the slope, and many of the finer residences have been lately built along the upper edge of the bluffs and overlooking the valley and lake for miles.

Just below Peoria an important railroad bridge spans the river, and at several other towns below there are railroad bridges, as at Pekin, Havana, and two or three smaller places. Below Pekin the railroads do not follow the valley but cross it The lower part of the river is chiefly important as a navigable stream connecting the Mississippi with the canal and Lake Michigan. Steamboats regularly pass from St. Louis to Peoria and Peru, and the towns on the river furnish a good market for grain which is sent to Peoria and Chicago. The Spoon river from the west, and the Sangamon from the east are the chief branches of the lower Illinois, draining rich prairie lands which are among the best settled portions of the state.

Springfield, near the Sangamon, is noted as the home of Lincoln, as the capital of the state, and as a beautiful city.

The lower valley of the Illinois River is pretty heavily timbered. For thirty miles before joining the Mississippi it flows parallel to that stream, separated only by a narrow ridge a few miles across. About fourteen miles above Alton it joins the great current of the Mississippi, here about a mile wide, and rolls on a few miles further to mingle with the yellow waters of the Missouri. The Illinois river is an important connecting link between the waters of Lake Michigan and the Mississippi River. The canal makes this connection complete, and the low, narrow water-shed between Lake Michigan and the Des Plaines renders this artificial water-way easy. When a ship-canal is finished between Chicago and the Mississippi, large vessels may be able to sail up the St. Lawrence and down the Mississippi making Chicago a harbor that can be approached from the sea on either side. In winter time the river and canal are frozen up and navigation is stopped for some four or five months.

The Illinois is useful not only for drainage, to remove surplus waters, for water power in mills and factories, for commerce, and as a means of connection between larger waters, but also for fishing which is carried on to quite an extent near the river towns.

The great irregular valley of the Mississippi is a still wider trough toward which the Illinois and other streams of our state send their winding waters. A closer study of the rivers of Illinois will show that they all move in the same general direction. The Rock, the Illinois, the Kankakee, the Big Muddy, and the Wabash all move in the same general course and all mingle their waters finally as they pass Cairo. Each of the smaller rivers has its secondary slopes, but the general slope of the whole state, with slight exception at Chicago, is toward the southwest. (It is certainly advisable at this point to make a sand map of Illinois, laying out the valleys, slopes, cities, canal, etc. If there is loose soil in the play ground, it may be made on a large scale and to good advantage in the open air. It is well also for the children to draw upon the blackboard quickly an outline map of Illinois aiming chiefly at correct proportions in the parts.)

If we now turn to a large physical wall map of the United States, it will supply a useful lesson at map interpretation to examine the neighboring states, such as Wisconsin, Iowa, Missouri, Indiana, and Minnesota, to hunt up the principal rivers, determine their slopes, compare them in size with the Illinois river, and fix their names, together with those of the states through which they flow. Such an examination will reveal several states that have a river of the same name,

dividing it into nearly equal portions, as Wisconsin, Missouri, and Minnesota. Then the Wabash in Indiana, the Des Moines in Iowa, the Kentucky, Tennessee, and Arkansas, bear a relation to their respective states similar to that in Illinois. This examination and comparison of rivers will lead to a perception of the chief slopes of the Mississippi valley on a large scale. In fact, we can afford to carry this comparison a little farther. The Illinois and Michigan canal, connecting Lake Michigan with the Illinois River, is similar to a canal at the portage of the Wisconsin and Fox. In Indiana, the Wabash and Maumee; in Ohio, the Miami, Sciota, and Muskingum are all connected with Lake Erie by canal. These are the artificial water connections between the Mississippi and the St. Lawrence system. Like the Illinois, the lower waters of streams such as the Wisconsin, Des Moines, Tennessee, and Sciota, are navigable, while their upper valleys are the favored courses of canals and useful for water power and manufacturing. The fullness and detail with which the upper and lower Illinois have been described, is justified because the canal with its locks, the dams and water wheels, the cities, bridges, and steamboats, the bluffs, bayous, and bottom lands of the one interpret those of all the others. In several ways the Illinois River becomes a standard of comparison by which we measure other streams, and more quickly understand their size and importance.

In our later study of rivers in other parts of the United States, and of the world, we shall have frequent occasion to revert to our home stream as a representative and standard to illustrate slack-water navigation, bluff scenery, water power, steamboat traffic and drainage, slope, and the erosive power of waters. In comparing the rivers of the surrounding states with the Illinois, we definitely locate these states and the rivers that drain them, fixing the names by such drill exercises as may be necessary. The power to interpret the surface features as indicated by a map should certainly be gained in this exercise.

A Coal Mine.

In many parts of Illinois the coal beds lie under our feet. Many towns and cities in the central and southern part of the state have good coal mines. So great is the value of the Illinois coal fields that the black soil of the prairies is scarcely a better source of wealth than the coal beds that lie from fifty to five hundred feet below the surface. About thirty-five thousand square miles, nearly two-thirds of our state, are underlaid by these rich coal deposits. The borings for coal in different counties reveal that sixteen distinct layers of coal have been found, ranging from one to nine feet in thickness. Sometimes three or four workable coal veins have been opened by a single boring, as at Bloomington and Springfield.

The coal beds lie in layers or strata. Like the rock strata of sandstone and limestone, from which our building stone comes, the coal seams lie in horizontal layers between the layers of rock and sand. When first formed upon the surface, they were not coal beds but consisted of a thick matting of reeds, ferns, and tree trunks. As the land sunk, water flowed over these beds, collecting thick layers of mud, sand, and gravel over them which afterwards changed into rock. The layer of plants and trees changed into coal.

The three most common ways of entering a coal bed are by *drift*, *slope*, and *shaft*. The drift is begun in a hill-side where the coal seam crops out. After removing the dirt and rubbish, a passage is worked into the coal. From fifteen to eighteen feet is the ordinary width, to accommodate two tracks, and ten feet will readily accommodate one. Seven feet is an average height, but it may be higher. The floor of the drift must have a constant upward grade as it progresses inward, in order that the water may run out, and that loaded cars may be hauled more easily. The mouth of the drift must be above the adjacent valley or stream, so that the water may be carried away. It is usually necessary to support the roof and sides of the drift by timbers, joined together in the form of a bent and placed more or less close to each other. The drift is the simplest and most economical way of making an entrance to a mine,

as there is no expense for sinking the shaft, cutting through the rock, pumping out the water, or the hoisting of the coal. But most of the coal-beds lie below the level of the streams and valleys.

If there is an outcrop of coal on the tract to be mined, and the dip of the seam (downward into the hill) is more than twenty degrees, it is usually advisable to enter the mine by means of a *slope.* This is a passage which, beginning at the outcrop, follows the coal-seam down until the necessary depth is reached. It is driven in the coal. The slope in some of the coal fields is driven down about 300 feet, at which point gangways are driven out to right and left, and chambers driven from them back toward the surface.

In early mining operations, the drift and the slope were much used in entering the coal-fields, as they were easier and cheaper, but most of the beds capable of being entered in this way have been mined out, and the coal-seam is now usually reached by a shaft. (Mines of Penn.)

The *shaft* is like a great well sunk straight into the earth. Before beginning a shaft, it is desirable to locate the coal-bed and its slant as nearly as possible. This is done by studying the rocks of the surrounding country and by boring. Since a shaft costs frequently from $25,000 to $100,000, it is desirable to make no mistakes in its location.

In beginning to open the shaft, an angular

space is started out from four to eight feet wider and longer than the proposed dimensions of the shaft, and the soil and loose stones are thrown out from large areas until the bed-rock is reached.

From this rock a cribbing of solid timber, twelve inches square, is built up to the surface, on the four sides of the opening, to prevent the earth from caving in. Sometimes heavy walls of masonry instead of the timber cribbing are built. When this has been accomplished, sinking through the rocks goes on by the ordinary process of blasting, plumb-lines being held at the corners of the shaft to keep the opening vertical.

The horizontal dimensions of the modern shaft average about twelve feet in width by thirty in length. The space is divided crosswise down the entire depth of the shaft, into compartments, of which there are usually four. The first of the compartments is the pumpway, space devoted to pipes, pump-rods, and other appliances connecting with the pumping system. To this, six feet in breadth are allowed. Then comes in succession the two carriage ways, each of which may be seven feet wide, and finally the air passage, by which the foul air is exhausted from the mine, and to which ten feet are appropriated. The air passage is boarded up and made as nearly as possible air-tight. The carriage in each of the carriage passages is raised and lowered by a wire cable, fastened to the middle of the cross-beam above.

The cars of coal, as well as the men, are raised and lowered by means of these carriages, and great care for safety is taken in their construction and use.

The safety carriages are now generally in use in at least one of the hoisting passages. It is built of wrought iron instead of wood; it has a bonnet or roof to protect against falling bodies, and it has safety clutches or dogs to stop the carriage and hold it in place in case of accident by breakage of the rope or machinery.

It costs usually from $300 to $500 a yard to sink a shaft with four such compartments, and sometimes a shaft that has been begun at a great expense may have to be abandoned because of the great rush of water or of a bed of quicksand.

It is usually intended to sink the shaft at such a point that its foot will strike the lowest part of the coal bed, which usually slopes. In working out into the coal area from the foot of the shaft, the slope will always be upward and the water will flow toward the foot of the shaft whence it can be pumped out. Usually a sort of water basin is excavated on the lower side near the foot of the shaft. In this cistern the water collects from all parts of the mine and an engine above pumps it through the pipes of the water passage and discharges it above ground. Sometimes it takes a powerful engine constantly pumping to keep down the level of the water in the mine.

From the first it is necessary to secure a good *circulation* of air through the passages and chambers so that foul air and gases produced in the mine can be constantly removed. From the foot of the shaft, on one side, a passage is cut through the coal from ten to fourteen feet wide. This is one of the main gangways. After reaching a short distance, a narrow passage, six feet wide, is cut at right angles to the gangway to a distance of from fifteen to thirty feet. At the extremity of this cross heading a passage is run parallel to the gangway. After running the gangway and this last air-passage parallel for a distance of sixty or more feet, they are connected again by a cross heading. It is evident now that we have a square enclosed by tunnels, namely by the gangway, the air passage, and the two cross headings. It is possible, therefore, to cause the fresh air to pass round this square and to return, collecting the gases and other impurities on the way through the passage and driving them back on its return to the foot of the shaft where they are all carried up the air-passage to the open day. By means of a wooden partition in the gangway, and an extra air-passage, the foul air on its return is kept separate from the fresh air that enters the mine from the main shaft. This current of air is kept in motion by a fan driven by a steam engine. It stands not far from the foot of the shaft and sends the foul air in a strong current up the

shaft. The fresh air passes down the carriage or elevator passage to make good this deficiency. In this way a constant circulation is kept up in the mine. This constant stream of fresh air is necessary to the miners because the fire-damp and other foul and explosive gases collect rapidly in the mine, and would soon make it not only dangerous but impossible to work longer.

As soon as proper arrangements have been made for the circulation of air and for pumping out the water that constantly accumulates, the regular work of mining the coal can be begun. The coal between the main gangway and the air-passage is left standing as a support to the roof of the mine. The miners begin now to open a way from the air passage outward, and after a narrow opening, wide enough for a coal car, has been cut to a distance of fifteen feet, the miner begins to mine away the coal and form a chamber from twenty-four to thirty-six feet wide; a track is also laid from the chamber to the foot of the shaft. The coal is removed by the car on the track and carried to the mouth of the shaft to be raised above ground. A second chamber parallel to the first is then dug, connecting in the same manner with the air-passage. A partition of coal from fourteen to twenty feet thick separates the two chambers. In order to secure a circulation of air through these chambers a passage is cut through this partition and the air passage outside of the

chambers is closed up by a wooden partition so that the air in its circuit passes through the chambers. The chambers are now extended deeper into the vein of coal; at every twenty-four or thirty-six feet a new air passage is opened up, while the old one is closed, thus causing the air to circulate close up to where the men are working. Several of these chambers are carried up parallel to each other into the vein of coal at the same time and as the coal is dug away it is removed in cars to the mouth of the shaft, while the air is kept fresh in them all.

The number of persons employed in a single mine varies from a dozen in the newest and smaller mines to seven or eight hundred in the largest and busiest. There are generally four workmen, two miners, and two laborers employed in each chamber. The miners are employed by the coal company and the laborers are employed by the miners. The miners belong to the aristocracy of the underground workers. After working a few feet into the coal, props usually become necessary to prevent the roof from falling. The hardwood props used are nine inches in diameter. They are furnished in large quantities by the mining companies. The miner as he advances into the coal sets up these props where there seems danger of the roof falling and makes them firm against the ceiling by driving a flat wedge between the top of the prop and the coal. This flat wedge

also remains and causes the prop to hold up a larger section of the roof of the mine.

Sometimes the props are not so much needed. The chief work of the miner is to blast out the coal from the face of the chamber and set up the props. When ready to begin blasting he takes up the drill, an iron rod, five and a half feet long, and more than an inch in diameter. It is sharp like a chisel at the point. With quick, sharp strokes and by turning the drill in his hands, the miner works a hole into the face of the coal about four and a half feet deep. After this hole has been cleaned out, a cartridge containing black powder is pushed into the farthest extremity of the hole. Fine moist dust is then pressed against the cartridge, leaving a small hole from which a fuse may reach the cartridge. The fuse is then laid in this hole and lighted. The miner cries "Fire" and the men hasten to get behind some pillar or wall of coal. The fuse burns slowly and the men have plenty of time to escape from danger. The explosion throws out a considerable quantity of coal into the chamber in large and small pieces. Soon the miner is at work boring another hole for blasting. But the boring is often very difficult and laborious; sometimes the miner works on his hands and knees, sometimes lying on his back on the wet floor, sometimes holding the drill high above his head, sometimes he uses a machine drill worked by a crank. When the

miner has blasted down the coal and set up the props, his day's work is done. He enters the mine at seven or before, and often has his day's work done by ten or eleven o'clock. The laborer has to break up the chunks of coal, load into the cars, move the cars to the gangway, and keep the chamber clean for work. His day's work lasts longer than the miner's, but he hopes some day to be a miner himself.

Boys are often employed in the mines to drive the mules back and forth from the foot of the shaft with the trains of cars. Sometimes they open and close the doors in the air passages. In Pennsylvania they are prohibited from working in the mines under fourteen years.

The dangers connected with mining are numerous and the law requires that many precautions shall be taken to prevent accident and death. Some of the chief dangers are from caving in of the roof, from explosions of fire-damp, from deadly gases, from flooding the mines with water, from fires in the shaft or in the tunnels. Besides these, there is danger from the falling of cars and other objects in the shaft, from collisions between the cars, etc. One of the most common dangers is from the caving in of the roof; in spite of the care taken to prop up the roof with heavy posts, the roof caves in, breaking the posts and crushing the men to death. It happens sometimes very suddenly, and in some cases several acres of

tunnels have fallen at once, burying many men. At times the men can tell by the creaking noises that the roof is about to fall and can save themselves.

Fire-damp and other inflammable gases are constantly oozing from the coal in some deep mines, and unless the current of air is strong, they collect and are ignited by a lamp, causing an explosion. As these burning gases, being lighter than the air, lie along the roof of the mine, the miner throws himself with his face to the ground and his arms around his head to escape the heat above. But as soon as the gases have burned out, he rises quickly and escapes, as the poisonous after-damp, or smoke from the fire, settles to the ground, and a single breath of this will suffocate the miner.

In some cases a flood of water and mud has been known to break through the wall of the mine and drown or bury the men suddenly. This is especially apt to be the case when a new mine is being worked near an old, abandoned one, in which great quantities of water have been allowed to collect.

Fires have sometimes broken out in mines resulting in the death of hundreds of workmen. Men are suffocated by the smoke, heat, and gases produced. In a few cases the buildings over the shaft have first taken fire and then the woodwork in the shaft, and gradually the mine below. Of course the air currents were stopped and the men below suffocated.

The machinery connected with a large coal mine is varied and extensive. Not far from the entrance to the shaft are the engine houses for hoisting the carriages, coal, men, etc., also the engine for pumping the water from the mine. The elevators or carriages have tracks on the floor upon which the loaded coal cars can be run. Mules are used in the gangways and air passages for hauling the cars to and from the shaft. Sometimes a stable is fitted up in the mine and the mules are kept below. Wooden tracks are laid for the cars. Air boxes are laid in places for conducting fresh air. Besides these things there are tools, powder, lamps, and oil needed in mining.

Above ground in the anthracite coal regions is the large building known as the *breaker*, where the large chunks of coal are broken between great revolving wheels or cylinders with pointed iron teeth. The broken coal then passes into wire screens with small meshes, through which the fine pieces drop, and the coarser pieces passed on to coarser screens till at length the larger pieces are dropped through. In this way the coal is separated into several varieties according to the size of the lumps, such as lump coal, egg coal, nut coal, etc. In the breakers, boys are also employed to sit in the troughs and shutes to pick out the pieces of slate and stone and throw them to one side.

"The first visit to a mine is full of strange sights and sounds. The first noteworthy thing is

the descent on the cage or carriage. Under the care of one of the mine foremen, we were allowed to go down. From the head to the foot of every shaft a speaking tube extends, and signaling apparatus which is continued to the engine room. At the head of the shaft is stationed a headman and at the foot of the shaft a footman, whose assistants aid in pushing the cars on and off the carriages. The footman is notified of your coming as you take your place in the empty safety carriage. It swings lightly as you step on it realizing that besides the few inches of planking under your feet there is nothing between you and the floor of the mine five hundred feet or more below you. When all is ready the foreman cries "Slack off!" the carriage is slightly raised and the descent begins. If the carriage goes down as rapidly as usual, your first sensation will be that of falling and your first impulse will be to grasp something above you. Then it will seem as if the motion were reversed and there will be an alternation of these sensations during the minute or two occupied in the descent. Finally the motion of the carriage becomes suddenly slower and you feel it strike gently at the bottom of the shaft. As you step into the darkness nothing is visible to you except the shifting flames of the workmen's lamps. After a few minutes you are able to distinguish objects that are ten or fifteen feet away. You can see through the

murky atmosphere the rough walls of the solid coal about you, the flat, black, moist roof overhead, the mine car track at your feet. The carriages appear and disappear and are loaded and unloaded at the foot of the shaft, while the passage at one side of which you sit is filled with mine cars, mules, and miner boys in apparently inextricable confusion. The body of a mule looms up suddenly in front of you, you catch a glimpse of a boy hurrying by you; a swarthy face lighted up by the flame of a lamp gleams out of the darkness, but the body that belongs to it is in deep shadow; you cannot see it.

"Bare, brawny arms become visible and are withdrawn, men's voices sound strange, there is a constant rumbling of cars, a regular clicking sound as the carriage stops and starts, incessant shouting of the boys; somewhere the sound of falling water. Such are the sights and sounds at the shaft's foot. If now you pass in along the gangway, throwing the light to your feet to see, there will be a sense of confinement in the narrow passage with its low roof and close, black walls. Occasionally you will have to crowd against the rib to let a trip of mine cars pass by, drawn by a smoking mule, in charge of a boy with soiled face and greasy clothes. You are lucky if you are in a mine where the roof is so high that you need not bend over as you walk. The men whom you meet have little lamps on their caps, smoking and

flaming in the strong air current. Everything is black and dingy. Now you come to a door on the upper side of the gangway. A small boy jumps up from a bench and pulls the door open for the party to pass through. As it closes behind you the strong current nearly extinguishes your lamp. You walk along the air-way for a little distance and then you come to the foot of the chamber. Up somewhere in the darkness, apparently far away, you see four lights twinkling. They appear and disappear. They waver from side to side, they bob up and down, till you wonder what strange contortions the people who carry them must be going through to give them such erratic movements. By and by there is a cry of "Fire!" It is repeated several times. Three lights move suddenly down the chamber and disappear, then the fourth one approaches and disappears also. The men who carry them have hidden behind pillars. You wait, one, two, three minutes, looking into the darkness. Then there is a sudden wave-like movement in the air, it strikes your face; you feel it in your ears; the flame of your lamp is blown aside. Immediately there is a sound of explosion and the crash of falling blocks of coal. Soon the lights reappear, all four of them, and advance toward the face. In a minute they are swallowed up in the powder smoke that has rolled out from the blast. But when the smoke has reached and passed you the air is clear

again, and the lights twinkle and dance as merrily as they did before the blast was fired. Now you go up the chamber, being careful not to stumble over the high caps into the notches with which the wooden rails of the track are lined. On one side is a wall built up with pieces of slate and the refuse of the mine; on the other you can reach out and touch the heavy wooden props that support the roof. Up at the face there is a scene of great activity. Bare-armed men, without coat or vest, are working with bar and pick and shovel, moving the fallen coal from the face, breaking it, loading it into the mine car which stands near by. The miners are at the face prying down loose pieces of coal. One takes his lamp and flashes its light along the black, broken, shiny surface, deciding upon the best point to begin the next drill hole, and giving quick orders to the laborers. He takes up his drill, balances it in his hand, strikes a certain point on the surface with it, turning it slightly at each stroke. He has taken his position lying on his side perhaps, and then begins the regular tap, tap of the drill into the coal. The laborers having loaded the mine car, remove the block from the wheel, and now, grasping the end of it firmly, hold back on it as it moves by gravity down the chamber to the gangway. You may follow it out, watch the driver boy as he attaches it to his trip, and go with him to the foot of the shaft.

"You have seen something of the ceaseless activity and noise of a mine when hundreds of men are at work. But when you are alone in such a place, or in an abandoned mine, the stillness is profound like nothing above ground."

The above description applies especially to the anthracite coal region, where the coal is got out by blasting, and large buildings above ground, called *breakers*, prepare the coal by crushing and separating it for the market.

The bituminous, or soft coal fields, are worked upon a somewhat different plan. The seams of coal do not lie so deep, drifts are much more used, and instead of drilling holes into the coal, grooves are cut, and then by prying or blasting, the coal is got free. The soft coal beds are more level and uniform, and for this reason more easily worked.

If we turn to the uses to which coal is put after reaching the surface, we shall begin to see the importance of this business. The mines are usually along railroad lines or rivers, which distribute it to those districts where it is most used. The railroads themselves consume a great deal in their locomotive engines for freight and passenger service. The railroad machine shops depend upon coal for putting their machinery in motion, for their furnaces, forges, stationary engines, etc. In our towns and cities the multitude of factories depend almost entirely upon coal, as in car shops, rolling mills, glass works, foundries, factories for

the manufacture of carriages, furniture, boots and shoes, cotton and woolen goods, paper, printing presses, farming implements, etc. Except when water-power is used in flour mills, woolen mills, etc., most of our factories are run by steam engines. Coal is also of importance in most households for heating purposes. Dwellings, school houses, and buildings of all sorts are heated generally by the use of coal. It is clear, then, that coal mining is one of those occupations that is necessary to the success of nearly all other kinds of business, and to the comfort of most people in their homes. The men who are digging in the dark earth far below the surface are supplying all other classes of people with the means of doing business and of living in comfort.

That the prairie states of the West be well supplied with coal fields is of special importance. Without these underground riches, the states of Illinois and Iowa, for example, could not settle up so rapidly; railroads could not have been built and operated, and farmers could not ship the rich products of the prairies to the East and receive in return the manufactures and other exchanges of that section.

Let us observe the location of the chief coal-fields. In Illinois they extend over about two-thirds of the state south of a line drawn from Rock Island to Joliet. The coal lies at different depths and in separate strata. In a number of

places the coal veins crop out along the banks of creeks and rivers, as at Danville, Peoria, etc., but usually vertical shafts are sunk from a hundred to five or six hundred feet deep. In the south central part of the state some of the coal beds lie more than a thousand feet below the surface, but only the upper veins, nearer the surface, are yet worked. Many thousands of men are employed in the coal mines of Illinois. In 1889, 11,597,963 tons of coal were mined in Illinois, which stands second only to Pennsylvania in the amount of coal produced.

Several of the neighboring states also have extensive coal areas. A strip along the southwestern part of Indiana yields much coal. This is a continuation of the Illinois field, and extends south through Kentucky into Tennessee. Altogether these four states have about sixty thousand square miles of coal area.

Another extensive coal field, larger still, extends through central and western Iowa, into Missouri, Eastern Nebraska, Kansas, Arkansas, and Indian Territory. The whole western slope of the Alleghany mountains also has rich coal deposits, as in Pennsylvania, West Virginia, Ohio, Kentucky, Tennessee, and Alabama. In Michigan, Colorado, and Texas, there are also smaller coal areas, besides those east of the Alleghanies and west of the Rockies. (In order to fix these coal fields definitely, consult the map on page 53 of Tilden's Commercial Geography, Leach, Shewell, Sanborn & Co.;

also Frye's Complete Geog. p. 137.) Locate the coal fields by states on a map and draw the map.

Notice, on a large map of the United States, the cities which lie in or near the coal fields, and see if they have any relation to the shipping of coal. Observe, also, any navigable rivers which may be useful in distributing this coal. Let teacher and pupils draw a map of the Mississippi valley, locating the coal areas by states; also the cities and rivers above suggested.

The careful and detailed description thus far given of the business of coal mining, is designed to bring out clearly its importance as related to commerce, manufacturing, and domestic use, so that when we touch upon coal mining and the other occupations to which it is related, we shall at once see their significance.

Later in the study of other kinds of mining operation, as in lead, silver, zinc, and gold mining, the knowledge gained from coal mines will be of much service, and a comparison with coal mines to point out differences and similar methods, will be helpful. The knowledge gained from a full study of a single typical coal mine in the Mississippi valley will help not only in understanding coal mines in other parts of the United States and in the world, but also for interpreting all kinds of mining operations.

NOTE.—Most of the above facts are obtained from Greene's Coal and Coal Mines, published by Houghton, Mifflin & Co.

The Prairies.

Illinois has been called the "prairie" state, although other states, like Iowa, are perhaps still better deserving of the name. When the white men first explored this state they followed the rivers in canoes and, as the bluffs, bottom-lands, and ravines near the streams were covered largely with forests, it seemed to them much like a wooded country. But when they climbed the bluffs to hunt the herds of deer and buffalo, they saw great stretches of beautiful rolling or level lands, treeless for miles, and covered in summer with a rich wild grass and bright with thousands of wild flowers. These waving prairies were the favorite hunting grounds of the Indians and were grazed upon by herds of buffalo and deer. The prairies were dotted over with ponds, which, in their season, were covered with wild geese and ducks. The prairie-chicken, wild turkey, and other smaller game were also abundant. In the strips of timber, bear, wildcat, and squirrel were hunted. The Indians depended for food largely upon their regular hunting seasons and the early white explorers and settlers supplied themselves in the same way. Many old settlers are still living in Illinois who have seen the deer quite abundant on the prairies of our state.

This prairie region, though beautiful and attractive as a hunting ground, was not deemed of

much value by the early settlers. The prairie often extended for ten or twenty miles between the strips of timber.

The prairie which lies north and east of Bloomington, Illinois, is a good type of these treeless plains. Bloomington was built in the edge of a strip of timber along Sugar Creek. To the north the rolling prairie extended nine or ten miles to Hudson, where another strip of woods is met. A line of woods about six miles west of Bloomington, forms the western limit of this prairie. Near Towanda, about nine miles northeast of Bloomington, the woods again limit the prairies on that side. The main body of this prairie, then, is about nine miles by twelve and is a rolling country of great beauty and richness. In the summer time the wild grass grew to the height of a foot or a foot and a half and, before the prairies were broken by the plow, was often mowed and the hay preserved. In the fall when the grass was dry and some hunting party had set fire to it, the flames would sweep across the prairies with a great roar and cloud of smoke which proved fatal to animals and men in their track.

The early settlers of Illinois built their log houses near the streams in the strips of timber that bordered them. The wooded parts of the state are along the valleys of the rivers and smaller streams. Oak, hickory, walnut, maple and other hardwood trees form quite extensive

forests along the rough or hilly country that lies close to the river valleys. These woods furnished the early settlers with materials for building houses, fences, barns, and for wagons and other farm tools. The woods also supplied an abundance of cheap fuel, while game was hunted among the groves. In fact for many years in the early settlement of Illinois, the forest districts were much more valuable and useful than the prairies.

In those early days of our grandfathers there were few wagon roads, to say nothing of railroads. Many of the early settlers from the East came by water, some by way of Lakes Erie, Huron, and Michigan to Chicago, and some by way of the Ohio, Mississippi, and Illinois Rivers. They loaded their household goods on flatboats or steamboats at Pittsburg, passed slowly down that river to its mouth, and then up the Mississippi and Illinois to Peoria, or some other river town, from which they secured teams to carry their goods across the country to the place of settlement.

The first white men paid little attention to the prairies. These broad, waving meadows, extending often for many miles, were not much used, except for hunting and pasture. But the prairie lands bordering the timber were often turned into fields for corn, potatoes, etc. One reason why the prairies were not used at first was the fact that not much grain was raised for shipment. There were no roads or good markets for grain, and the

farmers only raised what they needed for family use or for feeding their stock.

But the soil of the prairies was much deeper and richer than that in the wooded regions, and the farmers learned in time that it was profitable to break up the prairies with the plow and raise grain, instead of cutting down trees, grubbing out stumps, and clearing the land for fields among the forests.

The farmers, however, who began to settle upon the prairies had a hard struggle to convert them into good farms. The soil of the prairie had never been turned by the plow. It was matted with roots, tough, and hard to break or turn. Two or three yokes of oxen hitched to a single plow were necessary to break up this old sod before the first effort at planting and cultivating could be made. The first season not much was raised, as the sod and matted roots must rot before a good soil was formed. But with the second year's plowing the soil was rich and mellow, and yielded abundant crops. It was necessary, also, to build houses, barns, fences, find springs or wells, plant orchards and small fruit, secure stock and simple farm tools and machines. For many years the timber used was cut and brought from the neighboring woods, or it had to be hauled from the mills, across the prairies.

In those early days the *prairie fires* were a cause of danger to the farmers. Most of the

prairie, of course, was unsettled, and when fires once started across them in autumn, feeding on the thick, dry grass, with a brisk wind, the farmer on the prairie was in danger of losing houses, stacks, and stables—in fact, everything which he had worked so long and hard to secure. Various devices were used by the farmers to prevent such losses. In the fall, when the grain had been stacked, he would burn away the grass around the stacks and farm yards, so that the autumn fires could not come near the stables, stacks, and houses—or, he would plow up a circle of ground about the stacks and stables for the same purpose. Sometimes, when the prairie fires came unexpectedly upon farmers who were unprepared, there were exciting efforts to beat out the fire and save the houses and grain.

Nearly every farmer who settled upon the prairies desired to surround his farm house with groves and orchards. Groves of cottonwood, maple, walnut, willow, and orchards of apple, cherry, and plum were planted. Gardens, with small fruit, were started, large fields and pastures fenced, regular roads were laid out, bridges built; in fact, so many changes were made in the whole appearance of the country that the Indians would scarcely recognize their old hunting grounds if they could return to them. Standing now upon some high point or knoll on the prairies, where the eye can travel many miles in any direction, instead of

a waving sea of grass, one now sees great rustling fields of corn, green meadows, yellow fields of oats and wheat as they ripen in the summer tide, the whole country dotted with groves and orchards, almost hiding the farm houses and barns, tall wind mills towering above the tree-tops busily pumping water for the cattle or grinding grain. In a distant village are seen the church spires, the tall grain elevators, and a railroad train moving across the country is carrying the produce of the prairies to distant regions.

The demand for trees for transplanting in groves and orchards upon the prairies has been so great that large *nurseries* are found in many parts of the state, where thousands of seedlings are raised, fruit trees grafted and grown for shipping and for transplanting. Evergreens, maples, fruit trees, grape vines, berry plants, rose bushes, hedge plants and many other ornamental and useful trees and plants have been abundantly supplied to the farms and gardens of the prairie regions. The nursery business is still a very important and extensive occupation in Illinois and other prairie states.

Many explanations have been attempted touching the cause of the treeless condition of these extensive plains in Illinois and in the neighboring states. One reason assigned is that the rainfall is less in the prairie belt than in the forest country farther east. Then the prairie fires which were accustomed to sweep the dry, grassy plains de-

stroyed largely the young tree plants. A third reason offered is that the black close soil of the prairies is not favorable in a natural state to the sprouting of young trees, but in the hilly slopes near the streams where a clay and sandy soil prevails forests are common. It is supposed by some that the prairies were originally wholly covered with shallow ponds and lakes, and as the water gradually drained off through the sloughs, the marshy edges of these ponds and lakes were unfavorable to the growth of trees. Whatever the causes may have been, extensive plains in this region remained with no vegetable covering but rich grasses and wild flowers.

The soil of the prairies is, in most places, a rich, black mold from one to two feet in depth, and produced by the decay of vegetable growth. Sometimes it is possible to plow for miles without touching sand or gravel. In spite of heavy crops the soil keeps its strength and by deeper sub-soil plowing, and by proper rotation of crops, it continues to yield abundantly. The rainfalls are also so regular that a total failure of crops has not been known in the sixty years of settlement, although some seasons are too dry and others too wet for good agriculture. It would be difficult, however, to find a country with a richer soil, or a more regular succession of good harvests.

Many low places among the plains were once

covered with ponds, sloughs, and extensive marshes, sometimes extending over thousands of acres where only a coarse, rank slough grass grew. These wet places could not be tilled and were of but little use. But as the prairie lands were settled up and converted into farms, the ponds were drained by open ditches or tiles which were used to draw off the sluggish waters. Some of these marshy lands cover whole townships, while the ponds and lower places on nearly every farm are benefited by tile drains. By means of this system of artificial drainage, the land has been brought under cultivation, and these are found to be the richest and most productive districts of the state.

The business of ditching and draining the prairies has been, therefore, an important part of the growth of the state. Ditching machines have been extensively used. The manufacture of tile for drainage has been carried on upon a large scale. The big round kilns used for burning the clay, and the great stacks of red and dark tiles of different sizes are frequently seen in the towns of the prairie region along the railroad lines.

One serious difficulty common to all the prairie regions of Illinois, is the "bottomless roads" during a good share of the winter and spring seasons. The rich, sticky soil of the prairies holds moisture only too well, and during two or three months of the year the highways are almost impassable with loads. Ditching the roads along

the sides and throwing up the dirt in the center does not remove this difficulty, and there is so little gravel or other material suitable for road-building that, as yet, no great improvement has been made.

After 1850, railroads began to be built across the prairies, bringing pine lumber and other materials to the farmers from Chicago and the lake regions, and making it possible to ship corn, wheat, cattle, and hogs to Chicago and other cities. Coal mines were also opened, and coal was much used upon the prairies instead of wood. Before the days of railroads, it was very difficult for the prairie farmers to get their grain and live-stock to market. They sometimes hauled wheat and salted meat a hundred miles to market in wagons Since 1850, therefore, the settlement of the prairies has been very rapid. Even as late as 1870, however, there were many prairies in Illinois that were unfenced and still covered with wild grass, upon which anyone could freely drive his herds. But since then most of the prairie districts have been fenced and plowed, and are now yielding large crops of grain or serving as pasturage.

The description we have given of the prairies of Illinois will answer, also, for most of the prairie states. Northern Missouri, the whole of Iowa, and southern Minnesota, are very much like the prairie lands of Illinois. The eastern half of Da-

kota, Nebraska, and Kansas, also, belong to the prairie belt, and are a corn, grain, and stock producing region like Illinois. The northern part of Indiana and the southern part of Wisconsin show extensive prairies. There is no fixed line between these prairies, and the arid plains of the west in Dakota, Kansas, and Nebraska. The one hundredth meridian may be taken as the line that separates the region of sufficient rainfall on the east from the arid plains on the west. West of the Mississippi, therefore, the prairies have a gentle slope upward till they are gradually changed into the grazing and ranch lands of western Kansas and Nebraska, where there is not enough rainfall with which to raise crops.

Before leaving the prairie region it is advisable to locate the chief rivers which drain the prairie belt, the direction of their slopes, the states and parts of states included, and perhaps a few of the chief cities or trade centers which lie within this district. It will be of interest, also, to notice how far the coal area, studied in the preceding topic, lies within the prairie belt, and to what extent the use of coal on the prairies is rendered easy. The definite location of the prairie states on a wall map, and the drawing of the states in outline will aid the fixing of these facts.

We shall find later, in discussing corn and live stock, lumbering in the pineries and hardwood forests, that much additional light will be thrown

upon the prairie country, and the comparison of it with the region of the pineries and hardwood forests will help to give a much more definite knowledge of the surface, commerce, and productions of those parts of our country.

The Pineries and Lumbering.

In Northern Wisconsin and Minnesota, where the forests of white pine abound, the short, cold days of winter are the busiest season of the year. The ground is usually covered with deep snow which contrasts with the dark green of the forests. But the branches are often loaded with snow and ice so that Jack Frost is monarch of all. In the autumn, every large lumber firm which has pine lands in this region prepares to make up a company of lumbermen to send into the forests to cut down and prepare the logs for the spring-time. The foreman of the lumber company scours the river towns, hiring men for the winter campaign. As soon as they have spent all their earnings in the boarding houses and hotels, the men are ready to pack up for the logging camp. Sixty men make up a logging camp of average size. Such a camp is located in the midst of the woods, near the bank of some stream, which, when the melting snows and rains of spring come, can float down to the far-away mills the great piles of logs which the men have collected upon its banks during the winter season.

We will describe such a lumber camp on a branch of the Upper Mississippi above Minneapolis. (See Scribner Magazine, 1893.)

The camp consists of several buildings "made of round logs and roofed and floored, generally, with rough boards. There is a men's camp, where the men lounge and sleep; a cook-camp, which is a large dining-room and kitchen combined, and a large barn where the hay is stored for the horses and mules; a granary, a blacksmith's shop, and an office for the foreman, with an extra bed for the proprietor. The men's camp for sixty men and the cook's camp are each about sixty by twenty feet. The men sleep in rough wooden bunks, ranged in double tiers along the sides of the camp. Formerly they lay on boughs or on hay with a single blanket spread over it, but in these days they have their bed-ticks stuffed with hay or straw." A big fireplace used to add cheerfulness to the great barn-like room, but now large stoves are used.

There is much work to be done about the camp, in the woods, and along the river, before the actual work of felling the trees and hauling the logs begins. A gang of men is sent along the river for many miles to clear it of snags. It is a heavy piece of work, wading into the icy waters, loosening the stumps and logs and dragging them out, with horses. The men camp on the banks at night and wade the streams and labor during the

day for weeks at a time. But at last the river is clear for the spring freshet. Early in the fall, road-makers are sent out to the lumber camp to lay out and prepare smooth, well-graded roads along which the heavy sledges, with horses, may safely haul the great loads of logs to the banking grounds along the river. The making of these roads is a very careful piece of business. "Along the lines which have been carefully laid out, the road-makers fell the timber, cutting it at the roots so that no stumps remain, log out the road to its proper width, and then, with plow and scraper, mattock and shovel, make it nearly as level and quite as solid as a railroad grade. The road-bed is sunk a little below the level. It is plowed out after each snow storm with great snow-plows, and sprinklers are run during freezing weather, making a solid bed of ice over which enormous loads can be hauled." The log sleighs are from ten to fourteen feet wide on the cross beams, and one or two teams are hitched to them. Of course, before beginning the winter's work, a large supply of food and materials must be hauled to the camp. Hay and grain for the horses, tools, sleds, blacksmith's materials, besides food, clothing, and medicines for the men are provided.

When finally the winter's work begins in earnest, a logging camp is a busy place. Squads of men are sent out to fell the trees; the teamsters are up early to feed and groom their horses, so as

to haul as many huge loads as possible to the river bank; the cook and his helpers are busy almost day and night, preparing and cooking food for the hungry men. The blacksmith is shoeing horses, and repairing sleighs and tools. The foreman keeps track of all the men, their time and amount of work, and must see that every man earns his wages.

The men are out early at the trees, working in pairs or groups, and engaged in a generous rivalry to see who can bring down the most trees and logs. The trees are now generally sawed down instead of cut with the ax. By driving a wedge into the saw-cut, a tree can be thrown into any desired direction. When the tree is down, it is divided off into standard lengths and sawn up. Then the logs are ready to be taken to the skids. "The skid-way consists of two logs about ten feet apart, laid perpendicular to the log-road and well blocked up, upon which a tier of logs is placed ready to be loaded on the sleighs to go to the banking ground." To get the logs to the skid-way, cattle were once much used, but now horses. Sometimes the logs are "snaked" along, being held at the end by a grappling hook called "skidding tongs;" but the big logs are dragged by a team, with a rude sled for one end of the log to rest upon. From the skids, where the logs have been piled up by the loaders into lofty tiers, they are rolled onto the sleighs. "When it comes to load-

ing these logs on the sleighs, judgment and strength and skill are equally required, the object being to get as large a load as possible." The logs have to be well balanced and firmly laid, or they slip and slide back. Sometimes the load is piled up as high as a load of hay, and contains many tons of logs. The teamsters then drive carefully along the smooth road. They pass men whose business it is to watch the road, fill up low places, smooth the track, and thus prevent the sleighs from sliding out or toppling over. At the banking grounds, again, great skill and strength are needed in piling the logs on the edge of the stream, where they may easily roll into the water, in the spring.

Deep and lasting snows are of great importance to the lumbermen. In some winters when there is little snow but much rain and slush, the skids are full of logs but the sleighs can not run. Many thousands of dollars worth of logs may be piled up but can not be brought to the stream. If the weather is cold, the sprinklers are set at work and an ice road is made, over which the loads will glide. In many cases railroads have been built into the logging regions and the logs hauled out by steam power to the banking grounds. The snow, then, is of great value to the lumbermen both for skidding and hauling the logs and for melting in spring-time so as to flood the stream and carry off the logs.

In the evening, after the hard day's work, the camp is a lively scene. The hard worked men have a hearty relish for substantial food and they get it in abundance. "At dinner there is a hearty bean or vegetable soup, and generally fresh beef. For every meal there are pork and beans, corned beef, potatoes, turnips, cabbage and sauer kraut, plenty of sugar, tea, coffee, molasses, gingerbread, dried apple pie, mince pies from mince meat bought by the half ton, sauce and butter. With sixty men, a barrel of flour must be converted into bread in about two days. After supper there is rest and entertainment. Along each side of the camp is a seat made of a thick, hewn slab for which the bunk frames furnish a back. When evening comes, ranged along this seat, or lounging in the bunks, the crew of men become a social club. Then jokes go round and tales and songs are sung, and if there is a fiddler in the camp dancing begins." But the men must soon get to bed so as to be up betimes for the morning's work.

There are many dangers and accidents, and the reckless boldness of the men in handling logs leads to broken limbs and mangled bodies. In piling the logs on the skids and at the banking grounds there is special skill and strength needed to prevent serious accidents. But the men are generous in helping an injured comrade.

"With the melting of the snow and ice in spring comes the breaking in and driving the

logs. The banking ground swarms with men armed with cant-hooks, furnished with strong pikes in the end, who attack the great tiers of logs as they lay piled in the landing. Teams hitched to lines, at the end of which is a hook similar to a cant-hook, are used to loosen the 'key log.' This hook is driven firmly into a log at the foot of the roll-way, and as it is pulled out the whole face of the roll-way topples forward into the stream. This must be repeated again and again. Sometimes while men and horses are tugging to loose the log it suddenly gives way and down thunders the towering mass of logs. The men jump for safety to the sides, they clamber and keep atop of the plunging logs, they jump for safety into the surging stream, coming out generally unhurt."

As soon as the logs are set afloat two crews of men are sent out to drive the logs down the stream to the boom, where they are collected and sorted. The forward crew is called the "jam crew," whose business it is to string the logs along the river so as not to let them pile up together and get wedged in the stream. Sometimes the body of logs lodges in a narrow passage or bend of the river, or upon some snag or sunken tree-top, and the logs must be loosened and again set afloat. A great log jam, however, is sometimes formed which extends for miles up the river. The force of the current piles up the logs in

great heaps, with tree trunks projecting in every direction. To break such a jam and send the loosened logs floating down the stream, is difficult and dangerous. A rear crew follows to gather up the stray logs that have become stranded along the banks and bayous when the water was high. With cant-hooks the crew of men roll the logs into the stream. Many logs are thus left high and dry on sand-bars and in the bayous by sudden floods and changes in the water. These must all be rolled down to the stream and set afloat. The heavy butt logs drag in the low water and must be helped over shallow places. The men wade into the chill waters, ride the logs over the rapids, and are wet from head to foot most of the time. But they get double wages for this arduous work and exposure.

At length the logs from different companies are collected, many acres of them floating along the bayous and river banks, above the boom. The logs of each company are marked with certain letters, and so squads of men from the different companies are set to work to collect the logs of each company by themselves and form large rafts, which are then sent down the river with rafting steamers to the saw-mills. Sometimes three or four hundred men are employed at a boom collecting and arranging the logs for many different companies.

The saw-mills lower down the stream are kept

very busy in summer and fall, sawing up the logs and stacking the lumber. Many of the lumbermen work in the mills in the summer and in the logging camps in winter. The machinery of the mills at Minneapolis was formerly run by the water power of the falls, but now most of the large saw-mills are above the falls and are supplied with steam engines. The sawdust from the mills is the only fuel used and much more is produced than is needed in the furnaces. The mill stands on the river bank and a great raft of logs lies floating in the water below, from which they are drawn up singly into the mill by means of an endless chain with hooks. A hundred men may be employed in a single mill and the circular and band saws, and especially the gang saws, turn out great batches of lumber in rapid succession.

Above the falls at Minneapolis are many of these large mills with extensive lumber yards, where vast quantities of lumber are stacked, while in the waters of the river are great rafts of logs waiting for the saws. In the same yard with the saw-mill is often found a planing-mill where the rough lumber is planed and worked up into window-frames, casings, doors, and other finishing lumber.

Most of the logs of the Upper Mississippi are worked up in the saw-mills at Minneapolis. Quite a number of the stray logs go over the falls and are received by mills in the cities lower down the

river. Minneapolis is therefore a very important center for the manufacture and shipment of pine lumber. The great prairies of Western Minnesota and Dakota call for immense quantities of pine lumber for use in house-building, for barns, bridges, fencing, and many other things. The railroads reaching westward from Minneapolis are largely engaged in hauling this lumber to the western towns. The mills at Minneapolis are constantly taking orders from these western cities, and the success of their business depends upon the amount of lumber needed on the farms and in the towns of the prairie regions. A failure of crops in Dakota is therefore a serious drawback to the lumber merchants of Minneapolis.

It is clear then that the pine forests of Northern Minnesota are quite important to the farmers of the prairie regions. But the winter snows in the pineries, the spring floods in the rivers, the saw-mills at Minneapolis, and the long railroad lines stretching westward, are necessary to bring the prairies and pineries into close and cheap communication. The lumbermen in their camps must also receive their flour, corn, and grain, besides beef and other meats from the farmers of the prairie districts. Thus the exchanges take place.

Having seen the movement of logs from the lumber-camps along the Upper Mississippi to Minneapolis, and the distribution of lumber from that

point westward, we may expand this idea to observe how far it is repeated in other states. There are several large lumber streams that flow into the Mississippi below St. Paul, as the St. Croix, Chippewa, Black, and Wisconsin. They send thousands of logs into the Mississippi which are sawed up at the great saw-mills at Wabasha, Red Wing, Winona, La Crosse, Davenport, etc. In fact nearly all the towns, large and small, along the Mississippi from St. Paul to St. Louis, are lumber towns with saw and planing-mills, and railroads stretching westward over which the lumber is shipped into Iowa, Kansas, Nebraska, etc. The leading industry in nearly all these towns is lumbering and milling. Again, if we look toward Eastern Wisconsin and Northern Michigan, both in the upper and lower peninsula, we shall find numerous logging rivers, lined with lumber camps and saw-mills. Thus it is that such immense quantities of lumber reach Milwaukee, Chicago, and other lake ports to be shipped west and southwest into the prairie region. Chicago is one of the greatest lumber markets in the world, because of the ship loads of lumber that come down to Lake Michigan and to other lakes from the lumber streams in the pineries. Bay City, Detroit, and other cities of the lower peninsula are important centers for the lumber business. If we care to extend this inquiry we shall find that that part of Canada which borders the lakes, the St.

Lawrence and its tributaries, is all a region of pineries and lumbering similar to that in Minnesota. Later in our study of the Eastern States we shall be interested to see that northern New York, along Lake Champlain and the Hudson, and the rivers of Maine, are the centers of a lumber business almost identical with that of the Upper Mississippi.

After such an inquiry as is just suggested, we are prepared to fix the region of pine forests in at least Minnesota, Wisconsin, and Michigan. In doing so we have an opportunity of locating those states more carefully, also the chief tributaries of the Upper Mississippi, and of the lake region and those cities which are important centers of the lumber trade and their facilities for this traffic.

It may be well at this point to compare more carefully the prairie regions already treated with the pine forests in regard to soil, climate, and general appearance of the country. The contrast is a striking one. These tall, gloomy pineries, rooted in a light, sandy soil which is good for little else, contrasted with the black mold of the prairies which supports only grasses and wild flowers, in its natural state. And yet these two regions are very necessary to each other. The study of the mines in the lake regions will make this still more apparent.

See on Pineries Scribner's Mag. 93. Information Reader No. 3, p. 195, Forests.

THE UPPER MISSISSIPPI.

The great river above its junction with the Missouri is very different from the stream below. Above St. Louis the river is lined with bluffs on both sides. It is a mighty trough, crooked and irregular, winding and twisting its way southward between high bluffs, which give great variety of scenery, and, being crowned with waving forests or steep with bare rocks, furnish splendid panoramic views as we pass up or down the river in a steamer. Many of the cities like Quincy, Davenport, Clinton, and Dubuque have a commanding position on the slopes and bluffs skirting the wide valley. Just above Davenport and Rock Island the river passes the rapids and rocky ledges which have made navigation at this point difficult and dangerous. Here also is the island which the government has made into a great park with arsenals and a military station. Between the island and the west shore the government has built a series of jetties and rocky buttresses in the channel to narrow and deepen the current. But during low water in July and August the steamers and barges have difficulty in passing these rapids. Here, as elsewhere, the river has broad bottom lands, often well wooded and furnishing a rich soil for corn and grain when not flooded. As we move northward the bluffs gradually grow higher and more commanding, the

streams coming down from the prairies on either side must cut much deeper channels in order to reach the river. There is a great profusion of forests along the bluffs, which give an appearance of luxuriance to the valley which is in keeping with the richness of the country.

Between LaCrosse and Winona the river valley reaches its grandest proportions, and its isolated bluffs appear almost as mountains.

Before leaving Winona, however, it is well to take a glance at the panoramic view there furnished. Standing on the bridge across the lake, which is really an old channel of the river, or at some other point where there is an unobstructed view, how far can the eye travel across the valley and along the bluffs on either side? Perhaps we shall not find a broader or more interesting sight than is spread out at our feet. As we go up the river we shall take notice if anything finer than this appears. At Winona the bluffs on the south and west sweep round in a great curve like an immense bow, and if a string were stretched from Trempealeau Mountain in the southeast to the corresponding hills in the northwest, Winona would lie inside, *i. e.*, between the bow and the string. The bluffs to the southeast look like distant mountains, while the receding ridges to the north appear almost like successive steps as they fade away into indistinct outlines in the distance. Standing on the brow

of the bluff more than five hundred feet above Winona we may look up the great river valley about thirty miles, and southward through the narrow gorge at Trempeleau to La Crosse, an equal distance. On the other side lies Wisconsin with its castled rocks and wooded ravines.

Without dwelling longer upon this, we embark, and soon find that the river has a devious course among the lowlands. The bluffs are by no means straight in their outlines, but the channel of the river is much crookeder. Why does the river make such a winding course among the sand banks, jogging from one side of the broad valley to the other? Just above Winona we know there is a network of bayous. How have they been formed. In times of spring floods the whole broad valley, from four to seven miles from bluff to bluff, is nearly covered with the rushing waters, old channels are cut off and partly filled while new ones are opened Even when the water is not so high the current is constantly changing the channel, drifting in sand in one place and washing it away somewhere else. Jetties are being built near Winona to deepen the current. They appear as narrow ridges of stone run out into the stream at intervals to confine the current in a narrow channel. We begin now to see what difficulties the pilot on our boat has to meet. Not only must he know all the windings of the current by day and night, even

in the dark, so as not to run aground, but he must keep track of the changes which take place by the drifting of the sands.

We are already familiar with the ravines that lie between the bluffs. On our left we soon see the still broader opening where the Rollingstone comes down to join the Mississippi. Here lies Minnesota City, one of the oldest settlements in the state. Just before reaching Wabasha, the opening in the bluffs on the west shows where the Zumbro river comes in, upon a branch of which Rochester is situated. Just beyond Wabasha the Chippewa, the great lumber stream of Wisconsin, joins the Mississippi from the north. The town itself, like Winona, is a county seat. There is also a bridge of boats across the river with a draw, through which our boat passes. It is a town much like Winona, only not so large. Sawmills and great piles of lumber, machine shops and factories can be seen. Being just below the mouth of the Chippewa, Wabasha can get lumber rafts from Wisconsin as easily as Winona can. Beyond Wabasha the Mississippi bends more toward the west, and not many miles up the river we enter Lake Pepin.

The bluffs are nearly as high along the lake as at Winona, but only about half as far apart. Nearly the whole valley, however, between the bluffs, is filled with a deep lake, twenty-five miles long and from two to three miles wide. On the

west, one long bluff, near Lake City, is entirely covered with forests. On the other side, in Wisconsin, stands Maiden Rock, from the top of which, according to Indian story, an Indian maiden jumped, because she was not allowed to wed the man she loved. Her name was Winona. Standing on one of the cliffs by Lake Pepin, one gets the finest view along the Mississippi in Minnesota. The bluffs themselves, rocky or covered with forests, are as fine as those near Winona, but between them lies the deep, dark lake, filling the whole valley. Several towns and villages are in sight along the margin of the lake. Steamboats and rafts move along over the water, while swift rumbling railroad trains may be seen, at times, going up or down the valley on both sides of the lake at the foot of the bluffs. This is a sight well worth studying, and to make it vivid and real, use the best pictures that can be obtained. The picture of Lake Pepin on page 111 of Niles' Elementary Geography, answers this purpose well, and can be at the disposal of every teacher.

Between the upper end of Lake Pepin and the mouth of Cannon River is the town of Red Wing, which not only has flour and saw mills, like Winona, but also a pottery where jars, crocks, and other stoneware are made. A kind of clay is found here which can be moulded into jars, etc., and after being dried is baked and burned in large

kilns or ovens. This reminds us of the way in which brick are made and burned in the brick kilns at home. Whatever additional facts of interest and pictures connected with this business the teacher can give will be of value at this point. At Red Wing there is also a boot and shoe factory, where boots and shoes are made much more rapidly than by shoemakers at their benches. How is it done? We said there were saw mills at Red Wing. Where do their rafts of logs come from? From the Chippewa? But the mouth of the Chippewa is too far down. Are lumber rafts floated down the Cannon River from the west? No. The Cannon River comes from a prairie country, or from a region where there are no pine forests. Perhaps there is a lumber river farther up the Mississippi coming from the pine forests. We shall see! Just above Red Wing, where the Cannon River comes in from the west, there is a broad bottom land as broad as the valley of the Mississippi River. A railroad from Red Wing follows the valley of this river toward the west to Cannon City, Northfield, etc. The Cannon River is lined with fine bluffs and wooded hills, and is a pleasant trip for sight-seers in fine weather.

But from Red Wing we keep up the Mississippi River to Hastings. Just before reaching this city we notice a large river coming into the Mississippi from the north, the St. Croix. This

is the great lumber stream for which we have been looking. It comes from the pineries and sends down great rafts of pine logs in spring time. It was at a narrow place in this stream that the big *lumber jam* recently occurred. If possible show a good picture of this and explain it. Many of the rafts for Wabasha, Winona, and other towns are first floated down the St. Croix. At Hastings is another great railroad bridge across the Mississippi which swings open at the sound of the steamboat whistle. This is the bridge where the trains of the Milwaukee road from Winona cross the Mississippi before coming to St. Paul. At Hastings, a little river, the Vermillion, comes into the Mississippi from the north. As it passes over the rocks it forms the beautiful Vermillion falls near the city. Hastings, too, has flour mills and saw mills. Why is it that every one of these towns along the Mississippi has large flour mills just as Winona has? Where does all the wheat come from that is ground in these mills? Why are all the important towns between Winona and St. Paul on the Minnesota side of the river—Winona, Wabasha, Red Wing, and Hastings? On our journey north we may have noticed that the bluffs are growing lower along the Mississippi. Before reaching St. Paul there are two other points of interest, Kaposia, the old Indian village just below the great bend, and Carver's cave in the white sandstone rocks just below St. Paul.

Here the Indian tribes were accustomed to gather at the opening of every spring.

As St. Paul comes in sight there seems to be a lower and an upper town. The lower town, where the wharves and stations are, is not many feet above the level of high water. This level land reaches back from the river in a sort of broad valley. Farther up the river we can see large buildings on the edge of steep, white bluffs. Several bridges for railroads and wagons cross the river to the south. Most of them slope to-toward the south side, because it is lower there. The steamboats can get up no farther than this, and at the wharf in St. Paul they unload their cargoes and take on such grain, flour, and produce as they may desire to carry down the river. The river barges also unload their sand, brick, and building stone at the wharf. Where does the building stone come from? Red Wing and Dresbach. We need some good pictures of the city and river at this point. Close at hand is the great railroad depot, with its many roads, and trains coming and going at all hours. On the way up the river we have noticed the railroad tracks and trains on both sides of the great valley. Which are more rapid and convenient, the trains or steamboats? Which do the greater business?

Here let us take a general survey of the surface features of the whole state. Briefly, it is as follows: At St. Paul or near there the Missis-

sippi and its tributaries branch out like a fan and drain the great interior of the state. Beyond this the Height of Land, a low ridge of rounded hills, circles about the sources of the Mississippi from the western to the northeastern part of the state. From this ridge one may look down on the streams and lakes which send their waters southward to the Gulf, or on the other side upon streams and lakes that flow northward into Hudson Bay. With chalk in hand, sketching the outline, the teacher may point out the forest and prairie regions of Minnesota; besides the pineries already noticed, the "big woods," then the courses of the Red River and Rainy Lake River, with such a description as is easily obtained from Niles.

St. Paul is really the head of navigation, but excursion steamers go up the river four or five miles to Fort Snelling and Minnehaha Falls. Both are on the west side of the Mississippi, the fort on a steep white bluff nearly a hundred feet high at the angle where the Minnesota from the southwest joins the Mississippi. This old fort, with its white walls and rock, the old meeting place of Indians, soldiers, and traders, is one of the most picturesque and historically interesting places in Minnesota. A high bridge crosses the river from the bluff at the back of the fort to the bluff west of St. Paul so that the old fortress is easily supplied with needed materials and provisions. Some two

miles farther up the Mississippi is the entrance to the valley and Falls of Minnehaha. It is a deep, narrow cañon a mile long and filled with trees and shrubbery. At the upper end of the valley, Minnehaha Falls tumbles over the semicircular rocks into the gorge and the water winds its way through the narrow valley to join the Mississippi. Grounds have been laid out for a park along the bluffs above and a street car runs hourly to Minneapolis. For five or six miles below the falls at Minneapolis the Mississippi River flows through a narrow cañon from eighty to one hundred feet deep. Just above the falls the river bank is only twelve or fifteen feet high. The falls have been slowly receding toward the north as the waters in tumbling over the ledge have worn and crumbled the rocks, and the deep, narrow cañon below is the product of the action of the falls. But by boarding up the falls with a framework of timbers and forming great chutes down which the water glides, the action of the water upon the rocks has been checked and the scenery destroyed. Bridges cross the river both below and above the falls. Those which cross below must span the cañon and are therefore much higher above the water. Just below the falls and on the east side are the extensive grounds and buildings of the University of Minnesota. They stand upon the bluff a hundred or more feet above the level of the river. Just above the falls are the extensive lumber

yards of a half dozen great sawmills. A long island divides the river just above the falls and both the currents above the bridges are almost filled with acres and acres of floating logs. This is the greatest center for the lumber trade of the Northwest. In the time of spring floods the river still makes a majestic appearance at the falls as it descends with a mighty rush the forty feet to the waters of the cañon below. Even in summer time when the water is low it is interesting to stand on one of the high bridges below and watch the stray logs come tumbling over the falls. One can observe, too, that the greater part of the current does not pass over the falls at all, but emerges in a great stream from the foot of the mills after passing through the large turbine wheels that move all the machinery of the greatest flour mills in the world.

There is much navigable water above the falls, and in spring time especially the rafting steamers are busy bringing down the log rafts to the mills. But there are several falls and rapids in the upper stream that furnish excellent water power as yet not much used, but hindering navigation. Navigation on the upper stream is also hindered by snags and obstructions, but these must be removed in spring time so as to free the river for rafts and steamers. The upper part of the river from a line sixty miles north of St. Paul is in the region of pineries, from which the pine logs come. This

is also the region of numberless lakes where hunting and fishing are still in their prime. Minnesota is said to have ten thousand lakes, and those most attractive for hunting and fishing and for solitude are on the high plateau where the Mississippi takes its rise. There the great woods are solitudes, the lakes and rivers are clear and fresh, and the fish and fowl abundant. The great river itself, in its early upper course, passes through a number of smaller and larger lakes as it makes the great bend to the east and south. It passes over many rapids and falls as it descends from the uplands, and steadily grows as new streams from the woods and lakes enter it from either side. In winter time this is a very cold country of deep snows and snow shoes, and a quiet but steady freezing atmosphere. But in summer it is the chosen land of the hunter and boatman.

The head waters of the Mississippi and of its tributary streams, with their lakes and forests, have become an object of great interest to the people dwelling along the banks of the river throughout its whole course, even to New Orleans and the delta. The woods, lakes, and streams of the upper Mississippi in Minnesota and other states are the great reservoir from which the floods come down to break the levees and flood the lowlands of Mississippi and Louisiana. Of course the sources of the Ohio and Missouri are equally responsible. Now, if these floods of water in spring time can

be checked and held back, in part at least, it will help to save the lower river from destructive floods. But in summer time the upper river, from Rock Island to St. Paul, is often too shallow for the regular steamers. If these waters, which have been held back in spring time can be let go to deepen the river in the drouth of summer, it will greatly aid the navigation of the upper stream. The government, therefore, has been at work for some years constructing and arranging for great reservoirs in the upper sources of the Mississippi, by which the spring waters may be held back. Still another advantage of such reservoirs would be that it would make the season of floating logs down the river longer and also supply the great mills at Minneapolis and elsewhere a larger water power in the summer time when it is needed. It is apparent, therefore, that all parts of the great river stand in close dependence upon each other. The great forests in the north are very important as a means of water preservation and must be protected for their great public value. In winter time the northern part of the valley is a reservoir from which to cut and ship vast quantities of ice to the south, while the other products of the north and south are exchanged by boat.

The purpose of such an excursion as this is to bring together into one connected series the idea of a river valley with all its living pictures and associated thoughts. The narrow, winding val-

ley, the panoramic views of bluffs, lake, and broad bottom lands, forests, villages, cities, industries, tributary streams, bridges, railroads, rafts, steamboats, and river commerce. All this is to become vivid and clear, and a good type of a great river valley upon dozens of streams the world over. The more good pictures and illustrations of these and of similar scenes on the Mississippi, the more vivid descriptions based on experience and reading, the better. One complete and detailed account of a river trip like this is more productive of knowledge and insight and more helpful to future geography study than a dozen superficially studied. What is true of the Mississippi will be found in the main to be true of the Hudson, of the Rhine, and of the Danube, and it will be ten-fold easier to understand one of these distant rivers and the country through which it flows if we first form a concrete and detailed picture of one of our own great streams.

Just as we have already dealt with the lumbering business in detail and with the upper Mississippi, we are ready now to do the same for the wheat and flour mills. We desire an exhaustive account of the work on a wheat farm, the plowing, sowing, harvesting, threshing, granaries, and marketing of the grain, the scenes from a great wheat field, a characteristic thing for Minnesota, small machinery used—plows, drills, self-binders, threshing machines. How the

wheat is brought to the stations and elevators, then carried by the chief railroad lines to Minneapolis and other river cities, to the big mills. At length we are prepared for such a description of the Minneapolis mills as is found in Niles' Geography. What is done with such quantities of flour after it is made in Minneapolis and Winona and other cities? Where do the hungry people live who want all this flour for bread? Have they anything to send us in return?

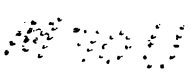
Hard Wood Forests of Indiana and the Ohio Valley.

Contrast the appearance of the Ohio Valley now and two hundred years ago.

Indiana is much of it to-day a well-wooded country. There are large forests of oak, hickory, maple, beech, poplar, walnut, sycamore, and other hard wood trees. The southern half of Indiana still contains extensive forests, while the northern quarter has level prairies and swamps. As one rides on the railroads through Indiana, he will see large piles of saw logs near the saw mills at the towns and cities. These are being worked up by the saw into useful lumber. If one travels out into the country he will find in the woods saw mills, run by water or steam power. Many of the fields are still sprinkled with stumps, and in some places we see the dead trees standing which have been girdled the last season.

After the trees die they are cut down; those good for lumber or wood are cut up and hauled away, while the brush and other tree trunks are burned up. These smouldering fires are often seen by the traveler passing through Indiana. During the last eighty years the great forests that covered the hills and plains and valleys of Indiana have been largely cut away, the stumps have rotted in the ground or were pulled up and burned. There are, therefore, many large open fields and districts of country where meadows of grass or fields of corn, wheat, oats, potatoes, and other grains or vegetables are seen. Indiana has thus grown to be a very rich agricultural state, with many cities, towns, and railroads. When the white men first began to settle Indiana and make homes in the wilderness, it was totally different from what is seen today. The great woods, with their towering trees, covered nearly the whole land. Very old men now living can remember when Indiana was one large forest with no railroads and very few wagon roads.

The early settlers in Indiana were the French at Vincennes and along the Wabash River. They were a joyous, happy people, who were very friendly with the Indians and were good wood-rangers and trappers. They hunted deer and buffalo, wild turkey and squirrels and other wild animals for their pelts. When they traveled it was either on foot as hunters, or in boats up and down the rivers.



At the close of the French and Indian wars the Yankees and other English speaking whites began to cross the Alleghany Mountains into the Ohio valley. From Pittsburgh they came down the Ohio River in flatboats and canoes and landed near the river in Ohio, Kentucky, and Indiana. The very first thing (as at Cincinnati) was to clear away the brush and trees of the forest, making room for houses and forts and gardens. As one rides in a steamboat along the Ohio River to-day, few of these old forests are seen left standing, They have been cut away from the bottom lands and the level upper bottoms, and only along the steeper hillsides and bluffs are many trees seen. As the early emigrants landed on the north bank of the Ohio in Indiana they had to make their way through the woods, up the ravines to the better lands back from the river (as in Lincoln's early boyhood). There were no roads for wagons, and when a good spot was found for building, trees were felled, a clearing made, and the rough tree trunks were squared down with a broad ax and a log-house commenced. The ends were notched and the logs jointed together at the corners. The pioneer was his own carpenter. He had saw and axe, plane and auger, and other tools, and was strong and skillful in their use. The log hut often had but one room, with a loft reached by a ladder or by pins driven into the logs, and it was used by the older children as a sleeping room.

The early settlers in Indiana lived partly by hunting and partly by raising crops on the clearings. Before crops could be raised, the trees had to be cut down and burned up, a very heavy labor, and when the stumpy field was ready it was ploughed and put in corn or wheat, melons or vegetables.

At first there were no public surveys, and the settler selected a spot to suit himself. "Deadening a patch of woods near the head of a spring, cutting the initials of the claimant's name on the corner trees, and throwing up any sort of a hut constituted an improvement! Division lines were chiefly on the water courses, or on the top of the ridges. The earliest farms, therefore, resembled an amphitheater. The cabin was always on the lower ground, which pleased the squatter because of its convenience; everything came to the house down hill."—(American Commonwealth, Ohio, p. 191.) Afterwards when the land was laid out by public surveys, these old farm houses were found to be far from the roads. Later people began also to build on the higher lands, but for many years the old settlers believed there was less ague in the lowlands.

"The millions who are dwelling in peace and plenty in the broad farms and busy towns of Ohio and Indiana to-day can get no realizing sense from mere words of the hardships by which their prosperity was earned. The toilsome journey of

the pioneers, the steep mountain ways, the camping out, where there were no inns and hardly a road to guide them, were as nothing to the dreariness which, at the journey's end confronted the immigrant and his devoted wife and tender children. The unbroken forest was all that welcomed them, and the awful stillness of the night had no refrain but the howl of the wolf or wailing of the whip-poor-will. The nearest neighbor often was miles away.

"Their first necessity was to girdle the trees and grub a few acres for corn and truck patch, sufficient for the season. As soon as the logs were cut a cabin was built with the aid of neighbors. Necessity invented the house-raising, as it did the log-rolling and corn-shucking" When the logs and timbers for the framework of the house were ready the neighbors were called in, and the heavy structure was lifted into place by the united strength of the men. When the work was done a feast and jollification followed. Neighbors were accustomed to help each other often in such ways, and to join in the corn-huskings, bear hunts, log rollings, and weddings, the latter lasting usually three days.

"The log house with its clapboard roof, single room and door, if any, swinging upon wooden hinges, with no window but a patch of greased newspaper between the logs, and no floor but the ground, was often finished at nightfall on the

spot where the trees had stood in the morning. The daubing of the chinks and wooden chimney with clay and a few pegs in the interior for housewife's use were all that this simple cabin in those days could afford."

"But food rather than shelter was the severest want of the pioneers. True the woods were full of game, but venison, turkey and bear meat all the time became tiresome enough. There was no bread nor salt. The scanty salt springs (salt licks) were precious. The Indian corn, when once started, was the chief reliance for man and beast. This crop, converted also into bacon, pork, and whiskey soon became the staple of the country. The lack of mills was at first deeply felt. Corn was parched and ground by hand or by horse power."

"The furniture of the cabins and dress of the people were very simple. Good tables, cupboards and benches were made of poplar and beech woods. The buckeye furnished bowls and platters and split-bottom chairs. Bearskins were bed and bedding. The deer skin, dressed and undressed, was much used for clothing, and the skins of the raccoon and rabbit were a favorite headgear. But wool and flax soon abounded and spinning wheels and looms became standard articles in every house. The hulls of walnuts and butternuts were used for dyeing, also a root of bright yellow, and later indigo and madder for the hunting shirt and warmus.

These primitive fashions yielded as store goods, together with iron and Onondaga salt began to be introduced by the great Pennsylvania wagons from Pittsburg and the ports along the Ohio. Goods were also brought up the river from New Orleans in keel boats."

"The pioneers had pastimes and festivities also in their own way. Besides others, there were the sugar camp, the militia musters, the bear hunts, the shooting matches, and the races. At these the neighborhood for miles around was wont to gather. The quilting party was a joy in feminine circles. The camp-meetings were another early custom, and used to supply the place of Sunday worship."

Traveling was at first mainly on foot and on horseback. There were few wagon roads, and those very rough and in many places miry and bad even in good weather. The great forests kept the soil moist so that the roads could not dry out. It was very difficult for some years to get the surplus grain and meat to market. In the spring, at the time of floods, flatboats would be loaded with meat or grain and sent down the smaller streams to the Ohio, and thence to New Orleans. When a few roads had been built, the farmers would haul their meat and grain many miles to Cincinnati or other river towns, and purchase goods with the money gained from their produce.

The early settlers in Indiana, Ohio, and Illi-

nois, needed a better connection with the eastern states from which they came. As early as 1808 they secured aid from congress in building a road from the tide water east of the Alleghanies to the Ohio river. This old national road crossed the Ohio river at Wheeling and ran across Ohio, Indiana, and Illinois, passing through Columbus, Indianapolis, and Terre Haute to St. Louis. As soon as it was built emigrants from the east came by wagons with all their goods to settle in these states, and goods were sent in great wagon loads to the east. As the country was settled up roads were opened through the forest in all directions, the swampy lands were crossed by means of corduroy roads, consisting of logs and boards laid crosswise of the wagon path in swampy places. It caused very rough riding, but was better than miring in the mud.

The early pioneers in the great forests of Indiana had another enemy in the shape of fever and ague and other diseases of a wet, malarial country. Much of the land was swampy and covered more or less with stagnant water, which the forests prevented from evaporating. Oftentimes no physicians were to be had, as the settlers were widely scattered; there were few towns, and medicine was hard to get. The milk sickness, supposed to have been caused from drinking the milk of cows that had fed on some poisonous plant, was a great plague. Fevers, agues, and bilious com

plaints were very common and the settlers used quantities of quinine as the great remedy. As the forests have been cut away and the wet and swampy places drained out, the country has become much more healthful.

In order to secure a better outlet for trade great canals were dug connecting Lake Erie on the north with the Wabash and Ohio on the south. The farmers living near the canal could ship their grain and meat much cheaper to Buffalo or Cincinnati or New Orleans, and new settlers could bring their goods by canal.

In Ohio, also, canals were built connecting Lake Erie with the Ohio, using the Maumee, the Scioto and Muskingum rivers. Beginning in 1826, 658 miles of canal were built in Ohio, at a cost of $14,688,000.00, besides improvements in the river channels by means of dams, feeders, etc. Large towns grew up along the line of these canals, and the whole country settled up rapidly.

The wagon roads were constantly improved. Gravel roads and turnpikes began to be built more than fifty years ago. If we visit the county towns (county seats) in Indiana to-day, we shall find a set of well graveled roads, smooth and solid even in muddy and wet weather, reaching out into the country and enabling the farmers at all seasons to haul heavy loads to the markets or to use their carriages in travel. These graveled roads have been a great expense to the farmers and towns-

people, but they are of great value for trade and travel.

Between 1830 and 1840 railroads began to be built in Indiana and Ohio, especially those running east and west, connecting eastern states with the western. When Indianapolis was first laid out in the center of Indiana it was in the midst of the forest. The White River, near which it stood, was not large enough for navigation, and roads had to be built to connect the city with Cincinnati and other cities. When the railroads were built Indianapolis became a very important center for the trade of the whole state. All the railroads from different directions meet in one great depot, which has come to be one of the greatest railroad centers in the world.

The forests of Indiana have always been of great value to the state. In the early settlement they furnished building materials for houses, barns, bridges, roads, fences, and for furniture, wagons, etc. Later the forests have been cut down for lumber such as poplar, hickory, oak, walnut, maple, beech, and sycamore. The forests of Indiana still furnish a large amount of hard wood lumber for the great factories and car works in Chicago, Indianapolis, and other cities. But in many parts of the state the finest lumber trees have been cut down, and what are left have an increased value. The black walnut, for example, once abounded in the Indiana forests, but most

of the walnut trees have been cut down and made into lumber for sewing machines, organs, tables, desks, and other furniture.

Indiana was only a part of the great hardwood forest region lying on the western slopes of the Alleghany mountains and stretching away hundreds of miles to the prairies of Illinois and Missouri. The early settlers who first crossed the mountains into the Ohio valley, and then floated for hundreds of miles down that stream, must have felt that the forest was endless. They began to cut down and clear away the great trees as if it would be impossible for the supply to give out. West Virginia, Pennsylvania, Ohio, Kentucky, Tennessee, Indiana, and part of Illinois and Missouri were covered by these great stretches of forest. All the country drained by the Ohio and its tributaries, the Muskingum, Scioto, Wabash, the Kanawha, Kentucky, Cumberland, and Tennessee, the Alleghany and Monongahela, was an almost unknown woodland. In those early days it was full of game and dangerous because of Indians. Buffalo, deer, wild turkey, beaver, raccoon, bear, squirrel, pigeons, and other wild fowls and animals were abundant.

At Marietta, the first large settlement in Ohio, Mr. King says (American Commonwealth's Ohio, p. 201): "Whatever their privations and dangers the adventurers were spared any fears of famine. Their fields and gardens were not only fruitful

beyond their utmost expectation, but the abundance of fish, flesh, and fowl was simply prodigious. Buffalo, deer, and bear, seemed to wait upon them. Geese, ducks, and pigeons swarmed. The fish fairly infested the rivers, and were of such superlative size, that if the accounts of them were not proved by good evidence, they might be set aside as fish stories. Col. May says that a pike weighing one hundred pounds was served up at a fourth of July barbacue, and catfish of sixty and eighty pounds were often caught."

But the appearance of this heavily forested region has changed greatly during the last hundred years. The wild game is mostly gone. The forests themselves have largely disappeared, and great fields of corn, wheat, oats, meadow, and pasture lands now stretch away where once stood mighty trees so thick that their shade darkened the ground. The swamps have been drained, roads and bridges built, cities and towns are thick, and the railroads extending in every direction cover the land with what appears on a map as a net work of lines and crossings. Great cities like Indianapolis, Columbus, Cleveland, Cincinnati, and Louisville have become the homes and trading places of hundreds of thousands of people where a little more than a hundred years ago there were no inhabitants at all, only forests and wild game and wilderness.

In our day the serious question is not how to

get rid of the forests, as with our grandfathers sixty years ago, but how to save them. The forests have been cut down too much not only destroying much valuable lumber, but changing the climate and causing the rivers to flood their banks in spring. The forests no longer hold the water back but it runs off too quickly in the spring time. The question of the future is therefore largely to protect the forests, to plant out trees, and to provide for an extension of the forest area.

It will be of special interest to compare the forest area of the pineries of the northern states with the hard-wood forest region of the Ohio valley. Which has the greater extent? The appearance of the forests in the two sections is very different. After the pine forests are cut down in the north a sandy somewhat barren soil is left, while the soil of the hard-wood region is strong and fruitful. A comparison of the hard-wood forests with the prairie region of Illinois, Iowa, etc , will also be of interest. The black soil of the prairies is contrasted with the lighter loam and clay of the forest belt.

References, King's History of Ohio, American Commonwealth.

MINNEAPOLIS.

Why has Minneapolis grown in a few years to be such an important city? It is but ten miles from the center of Minneapolis to the center of St. Paul

and the city of St. Paul was large and prosperous as a trading point and capital long before Minneapolis was thought of. In 1849 the first settler staked off his claim at Minneapolis near the falls. In 1890 the city had 164,700 people. This is a very marvelous growth and must be based upon very important and far reaching facts. St. Paul, for many years in its early history, was a place for the white settlers and traders to meet the Indians. Before the war the agriculture of Minnesota was not much developed, and the lumber business also was scarcely begun. But when railroads began to reach out to the prairie regions west of Minneapolis and St. Paul and as great numbers of settlers came in from the eastern states and the Scandinavians and Germans from Europe, Minneapolis began to grow.

The falls at St. Anthony were long noted for their beauty and grandeur before cities grew up beside them. Of course the water power was looked upon as of great value and when the pine logs began to be cut out of the northern forests and floated down the upper river, it was found that these falls were the best location for mills to saw up the logs. At first the water power was chiefly used by the sawmills, and as the prairie regions to the west settled up there was more demand for lumber for building purposes. In order to distribute this lumber and other products of the prairie country to the west railroads were

built branching out from Minneapolis. As this business of logging and lumbering grew, the whole Upper Mississippi with its tributaries became a network of rivers and logging camps for collecting logs to the mills at Minneapolis and other mill towns on the river. The large lumber firms had big sawmills at Minneapolis and thousands of acres of timber lands in the woods to the north, with their lumber camps in winter and their rafting steamers for guiding the log rafts south at the time of the spring floods. Many of the wealthiest men and companies of Minneapolis and other river cities have acquired their fortunes in this business and have built them splendid homes in St. Paul and Minneapolis. Closely connected with the sawmills are the planing mills for preparing dressed lumber, doors, sashes, and interior finish. Large factories were also established for the manufacture of furniture, agricultural implements, wagons and carriages, cooperage, and other kinds of woodwork. All these lumber products were then shipped westward over the scattering railroad lines into western Minnesota, the Dakotas, Iowa, and Nebraska. This rapidly growing prairie region, extending even to the Rocky Mountains and from Missouri to British America, demanded a vast amount of lumber for its rapidly developing cities and farms. It is evident, therefore, that Minneapolis, because of its position on the river, water power, and mills, should soon be the great

center of the lumber business of the Northwest. It collected logs from a large forest area on the upper Mississippi, worked over this raw material in the sawmills, planing mills, and furniture and other factories, and, by means of the many railroad lines spreading out westward, distributed this vast product over a very extensive region of prairie country. It is also clear that this important lumbering industry led thousands of people to find homes in Minneapolis and build up the city.

As western Minnesota was rapidly settled up with industrious farmers, who raised great fields of wheat, oats, barley, corn, and other grains, besides thousands of cattle and hogs, they naturally shipped their grain and other produce over the railroads to Minneapolis. It was not long before the rich soil of the western prairies and river valleys was found to be one of the best and largest wheat regions of the world. Not only are the rich upland prairies of southern and western Minnesota very fruitful in grain, where thousands and even millions of acres are yellow with waving grain in July, but the Red River Valley of the North is extremely fertile and favorable to wheat. "Close to the doors of the Twin Cities lies this Red River Valley, considered by some the third richest agricultural region in the world. It takes in many counties of western Minnesota and the eastern counties of the Dakotas. It reaches up

into Canada beyond Winnipeg, and its southern end is the richer. It is a level prairie land of black soil, that once formed the bed or deposit of an ancient sea. This region pours its wealth of grain into the two cities, there to exchange it for merchandise. The farmers sometimes have raised enough grain in one year to pay for their farms. One farmer made $30,000 in one season."

There are 8,832,000 acres in the valley, and in 1891 only about one-third was under cultivation, not all in wheat, but 30,000,000 bushels of wheat were grown, worth about $27,000,000. Most of the wheat of the northwest finds its way to Minneapolis, where the big mills convert it into flour. "In 1871 only two carloads of wheat were received in Minneapolis. In 1887 the Great Western Railroad brought thirty-three million bushels to the flour mills. It is thought that the summit of fifty millions of bushels will be reached in the twelve months of last year (1891). Of course a large part of this wheat is ground up into flour, put in sacks or barrels, and shipped eastward by way of Duluth and the lakes, or by way of Chicago, to New York and eastern states. A very large part of the flour made in Minneapolis is sent in shiploads to Liverpool or Hamburg, in Europe. The great railroad lines from the Twin Cities to Duluth and Chicago send long train loads to the east and to Europe, where millions of people make bread from Minneapolis flour.

It is found, therefore, that Minneapolis is the great center of trade and manufacture in a second important staple product, *wheat;* that it collects this product from a broad area by means of railroads, manufactures it in the big flour mills, and then distributes it over the eastern states by means of railroads and water-ways, and even sends millions of dollars worth of food to England, Germany, and other European countries. This vast business of wheat and flour milling also collects thousands of people in Minneapolis who build homes there, and many of the wealthy men of the northwest have based their fortunes upon this great business.

There is still a third line of business in Minneapolis that is as important as the two already described. Manufactured goods of all kinds, as dry goods, machinery, clothing, instruments, tools, paper and books, medicines, fruits and groceries, china and porcelain, hardware, farm implements, cutlery, and a hundred other important manufactures of the eastern states and Europe are shipped to the great trading and wholesale houses of Minneapolis and St. Paul, whence they are sent out over the railroads and distributed to the prairie and even mountain regions to the west and northwest. This immense trade centers in Minneapolis and St. Paul, which thus makes a great depot for the collection and distribution of products. The handling, sale, and shipment of

all these manufactured goods calls another large class of people to the Twin Cities, and gives the great railroad lines a large share of their business.

As a result of the description of the lines of trade and commerce centering in Minneapolis, we are able to see partly the reason for its very rapid growth and its great importance. It is easy to see that Minneapolis not only has a fine location on the river, which naturally makes it the center of the lumber trade, and a vast water power that makes milling cheap and profitable, but that by means of the river and the railroads it is brought into the closest relations with the extensive pineries of the north, the fertile prairies and river valleys of the northwest, and with the great centers of manufacturing and population in the east. The lake ports, Duluth and Chicago, enable it to send goods with small expense to New York and Europe. The Mississippi river on the south brings St. Paul in close communication by boat and cheap freight with the whole Mississippi valley from Louisiana to Pittsburg and Kansas City and farther. In early days this connection of St. Paul with the river was very important, as nearly all heavy goods reached St. Paul by boat, but since the railroads have grown so important the river trade has grown less.

We have already seen that Minneapolis was a natural center for the manufacture of lumber and

flour, but after these great industries were well started, many other large manufacturing plants became established, such as boot and shoe factories, furniture and wagon shops, smelting works, packing houses, and car works and machine shops, as well as many smaller manufacturing industries. The result is, that though of so short a growth, Minneapolis has already become a center for very large manufacturing interests, and the products are shipped to the broad regions of the west that Minneapolis supplies. These industries also have contributed to the rapid growth and wealth of the city. It should be remembered also that hundreds of thousands of settlers, seeking farms and homes, have come from New England and the northern states as well as from England and Scandinavia to develop the country and increase its population and wealth.

Besides all these wide-reaching influences, the city has a beautiful and elevated location above the river, with the best of drainage, with a natural forest that still shades much of the city, and half a dozen beautiful lakes and fine parks within the city limits or near them. The streets of the city have been laid out on a broad, liberal plan, and the street-car service is excellent. Many very fine public buildings and business blocks adorn the principal streets. The public library with 40,000 volumes is an elegant and imposing structure. The Guaranty Loan building, fourteen stories

high, is one of the finest buildings in America. The State University, on the east bank of the river, and other public institutions are on the same grand scale. It is a very healthy city and is especially noted for its great number of pleasant homes.

The city of St. Paul, only ten miles away, is not excelled by Minneapolis in progressive spirit and enterprise. It is especially the center of the wholesale trade of the Northwest and has excelled Minneapolis in the extent and variety of manufactures. Some of its streets of elegant residences along the bluff are among the finest in America. Its business streets near the river are somewhat narrow and cramped, but farther up along the bluffs the city is laid out on a generous plan.

It has been thought that these two cities would some day join their forces and make one great city. Already their suburbs touch each other, but the rivalry between them is very lively and sometimes bitter. It is estimated that before many years the two cities will contain a million people.

In conclusion, it will be profitable to compare Minneapolis and St. Paul with other great centers of trade in our own country which are somewhat similarly located. Pittsburg and Allegheny City, especially, at the head of regular steamboating on the Ohio, may well be compared with the Twin Cities of Minnesota. Pittsburg is also the center of vast exchanges of raw products and of manu-

factures from these products. Water and railway traffic are also equally well illustrated. Minneapolis and St. Paul are far away from the coal supply and that has somewhat hindered the growth of manufactures. How is coal obtained cheapest in St. Paul and Minneapolis? It may be well also to locate on the map carefully the great wheat and lumber districts that are tributary to St. Paul and Minneapolis and to draw in outline the states included. Compare these also with the corn belt and the prairie regions further south. Kansas City is also a place of modern growth that may well be compared as to its advantages with Minneapolis. It also controls the trade of a large area and collects and distributes products on an extensive scale. Later when we come to study the eastern states, the Twin Cities may also be compared with Albany and Troy at the head of navigation on the Hudson.

A full and detailed description of a single great trade center like Minneapolis will enable the children to see the causal influences which have really produced a great city. The lines of traffic cross each other in different directions and they see that where raw products are collected in such vast quantities manufacturing naturally follows. Minneapolis is an excellent type of these things, and stands out with sufficient distinctness to make these ideas apparent. As they study other cities in their later lessons they will be inclined to look

for the causes which make and keep alive the importance of great cities.

References, Harper's Magazine, March 1892, "The Capitals of the Northwest."

Lake Superior.

"Lake Superior is the largest lake in the world, and the largest body of fresh water. It is 380 miles in length, and 160 miles across at the widest part. Its watery area of 32,000 square miles proves it to be the size of the state of Indiana, or four times as big as Massachusetts. It is about 600 feet above the sea level, but the government charts show that in its deepest parts the water has a depth of 1,386 feet, so that there, at least, the bottom of the lake is more than 700 feet below the level of the sea. North of Keweenaw Point, on the south side, there is a depth of 1,008 feet, and great depths, above 500 feet, are scattered all about the lake. Its shore line is 1,500 miles in length."

The lake fills a great basin, which has a high, rocky rim all about it. The short, steep slope is toward the lake, while the long, gradual slope, after reaching the summit of the ridge, is away from the lake. More than 200 small rivers pour their waters into Lake Superior, but they are mostly short, with swift, foaming currents as they come tumbling over the rocks, down the steep slopes of the country surrounding the lake. These

rivers are not large and smooth enough for boating, but they supply splendid water power for mills, which will be used in time. The St. Louis river, at the head of Lake Superior, is one of the largest of these streams, and is often spoken of as the source of the St. Lawrence. This river makes some big leaps and falls as it descends the rocky ledge between the plateau of Minnesota and the lower level of the lake. The rivers tributary to Lake Superior drain a territory of 53,000 square miles, or nearly as large a space as Illinois.

The shores of the lake are very rocky, and only in a few places are there sandy or level beaches, especially along the southern shore. Along the north shore the steep, rocky cliffs rise a thousand feet and more above the water, and the lake is deep at their base. There are also many deep bays and harbors along this northern shore. The steep cliffs and deep water and bays of this northern coast make the shore scenery of the lake grand and impressive like that of the ocean on rocky shores. Along the central part of the southern shore, where the lake is widest, are the high sand stone cliffs known as the pictured rocks. As the winds and storms of the north drive across the lake, the great waves beat upon this southern shore with much fury and have washed out and chiseled the rocks into many curious and interesting shapes. The sand and gravel have also been piled up beyond the shore

line in white hills two and three hundred feet high. The shores on all sides are clothed with the dark evergreen forests, which extend far northward into Canada and southward into Wisconsin and Michigan. As the shores for many miles are not settled, fine hunting is still met in these wildernesses of forests and streams.

"At present there are trout a plenty in the streams that flow into the great lakes through the beautiful forests which clothe that enormous tract, in which, south of Superior alone there are said to be 500 or 600 little lakes. Exactly like it, from the sportsman's point of view, is the region north of the lake, where the land looks, upon a detailed map, like a great sponge, all glistening with water, so crowded is its surface with lakes and streams. In the north are the caribou and all the animals that the fur-traders of the Hudson Bay Company value. South of the lake there are no animals larger than the deer, but deer are abundant and bear are still numerous. In the fishing season a man may feast on trout, black bass, pickerel, muskallonge, partridge, venison, and rabbit.

"The city of Marquette, on Iron Bay, in the center of the most picturesque part of the south shore, gets its importance as a shipping port for ore and lumber, but it occupies the most beautiful site and is the most beautiful town, as seen from the water, of all those that have grown up on the

lake. It has a large and busy trading district on the sandy shore of the lake, but the fine residence districts surmount a high bluff which half encircles the town. Ridge street, two hundred feet above the lake may easily become one of the finest avenues in America, and already it numbers some of the most artistic and costly houses in the Lake Superior region. With its drives and neighboring forests, with its fishing streams and lake, it deserves to rank as a summer resort." Presque Isle Park, on a high rock promontory overlooking the lake, with a forest above and the steep rocks below, is hollowed out into caves which a boat may enter from the lake. The Pictured Rocks also are only a short distance east of Marquette, so that this entire region is one of great interest. This southern shore is also very important on account of the great iron mines in the Marquette range (seventy-two in number) and the large copper mines in the Keweenaw peninsula. The largest ore docks in the world are seen at Marquette.

There are also many islands in the lake which add to the interest and scenery. "Numerous islands are scattered about the north side of the lake, many rising precipitously to great heights from deep water, some presenting castellated walls of basalt, and others rising in granite peaks to various elevations up to 1,300 feet above the water."—(Cycloped. Britan.) The northern shore is also rocky and steep. "Its famed and stately walls of

rock delve straight downward into the water and rise sheer above it without giving nature the slightest chance to make a litter of dirt and rocks at their feet. While other rocky shores of other waters stand apart or merely wet their toes in the fluid, those monsters wade in neck deep and only expose their heads in the sunlight, sometimes 200 fathoms from the bottom. Terrible prison walls these become to the shipwrecked mariners, for they extend in reaches sometimes twenty-five miles long without offering a finger hold for self rescue. The largest of the islands is a part of the United States. In fact the greater part of the lake itself belongs to the United States, although the northern part goes with Canada.

The fisheries form an important business on the shores and islands. "The lake and the vast region around it are the sportsman's paradise and a treasury of wealth for those who deal in the products of the wilderness—furs, fish, and lumber. At little Port Arthur alone, (on the north shore,) the figures for the fishing industry for the market are astonishing. In 1888 the fishermen there caught 500,000 pounds of white fish, 360,000 pounds of lake trout, 90,000 pounds of pickerel, 48,000 pounds of sturgeon, and 30,000 pounds of other fish, or more than a million pounds in all. They did this with an investment of $3,800 in boats and $10,000 in gill and pound nets. This yield nearly all went to the Chicago Packing Company

and it is in the main Chicago and Cleveland capital that is controlling lake fisheries. The white fish, in the opinion of many, is the most delicious fish known to Americans. The lake trout are mere food, they are peculiar to our inland waters, they average five to ten pounds in weight and yet grow to weigh a hundred and twenty pounds."—(Harper's Mag.)

The fish are caught in nets, and, by the use of small meshed nets, the fishermen claim that millions of small fish are killed each year and the fishing is thus being seriously damaged. The fish commission has been trying to cultivate greater numbers of the best fish by putting "fry" yearly into the lakes. This, however, it is claimed, does not repair the damage done by the use of small-meshed nets.

The water of the lake is clear and cold at all seasons. It is almost ice cold in summer so that sailors and fishermen are quickly chilled by falling into it, but in winter it does not freeze over, so great is the quantity of water and so slowly does it change its temperature. The water is so clear that one can easily see objects at a depth of twenty feet, and the sailors claim even to a depth of forty feet. When the water is shallow it is distinctly green; but in deep waters it changes to blue when seen at a distance, and it has varied hues and colors according to the changes of the atmosphere and sunlight.

"One peculiarity of Lake Superior cannot be too strongly dwelt upon or exaggerated. That is its purity, the wonderful clearness and freshness of it and of its atmosphere and of its borders. It must become the seat of a hundred summer resorts when the people visit it and succumb to its spell." Already two of its summer resorts have become famous, Munising and Nepigon, while there is room and opportunity for many more along its 1,500 miles of rocky and forest-covered coast line.

Within the last few years the commerce of the lake has grown into very great importance. The lake surface lies twenty-two feet higher than Lake Huron and Lake Michigan, and until a canal and lock were built to connect the commerce of Lake Superior with that of the other lakes, little could be done to develop the trade of Lake Superior's cities. "As originally built, the canal in St. Mary's River was a mile long, had a width of one hundred feet at the water line, and a depth of twelve feet. The locks were two in number, each three hundred and fifty feet in length, seventy feet in width. At the time the canal was made these dimensions were sufficient to pass any vessel on the lakes fully laden, but by 1870 it became necessary to provide for more rapid lockage and for the passage of larger vessels. Accordingly the old canal was widened and deepened and a new lock constructed five hundred and fifteen feet long and eighteen feet wide. There

is now everywhere a navigable depth of sixteen feet from Lake Superior to Lake Huron. In 1883 the registered tonnage passing the canal was 2,042,295 tons. The United States government engineers have already presented a project for still further improvements, namely, to replace the old locks by one only, with a length of seven hundred feet, a width of seventy feet, and a depth of twenty-one feet." (Encyclopedia Britannica.)

"The date of the last enlargement of the lock is the date upon which to base all computations as to the lake traffic. The lock was enlarged and newly opened in 1881. Marquette, the 'Queen City of Lake Superior,' is an old place of former industry, but it is a mere baby in its present enterprise. Superior dates from 1852 'on paper,' but from 1881 in fact; while Duluth is only a few years older. Port Arthur, the principal Canadian port, owes itself to the Canadian Pacific Railway, now about seven or eight years of age (1892), and many of the future cities are not yet discovered." (Harper's Magazine, April, '92.) The Canadians have also built a canal on their side of the strait, so as to be independent of the United States. In 1890 nine million tons of shipping passed through the strait. But the increase of shipping was so great that Duluth and other lake ports were greatly dissatisfied because of insufficient lockage. In 1890 the depth of water in the canal was from 14¾ feet to 15¼ feet. The new government

lock, built at a cost of four millions of dollars, is one hundred feet wide, twenty-one feet deep, and one thousand two hundred feet long. On account of an accident to the old lock it was closed for a short time. It cost the companies who use the canal a loss of one million dollars and delayed about one hundred and eighty-three vessels each way.

Since 1881 a vast commerce has developed on Lake Superior. The great iron and copper mines all along the shores in Minnesota, Michigan, and Wisconsin; the wheat and other grains from the prairies of the northwest, loaded into ships at Duluth and Superior, and the thriving cities that have sprung up like magic on the shores of this great inland sea, have produced an amount of traffic that is worth many millions of dollars. Duluth has been regarded as a second Chicago and as a city with a great future. It lies much nearer the great wheat fields than Chicago, and 500 miles nearer the Pacific Ocean at Puget Sound. The Canadian and Northern Pacific railroads lead directly to Lake Superior at Duluth and Port Arthur.

The whaleback steamers at Duluth and Superior are loaded with wheat for Buffalo. One of them even passed through the Welland canal and down the rapids of the St. Lawrence to Liverpool. The great ambition of the Lake Superior cities is to secure a twenty-foot waterway from Duluth to

the Atlantic Ocean, so that large vessels of 6,000 tons burden can sail directly for Europe. From Marquette, Duluth, and other cities of Lake Superior, there are shipments every year of millions of tons of iron and copper ore, and of wheat. The lumber trade through the canal is also very important, and the shipment of coal from Pennsylvania to Duluth and Superior supplies the returning vessels a large part of their cargo. In this way Minnesota secures a comparatively cheap supply of coal, although the distance from the coal fields is great.

The season for navigation on Lake Superior lasts usually about eight months, from the middle of April to the middle of December. The sailor's life on the lake is a severe one. The storms are as rough as upon the ocean. In midwinter, although the lake is not frozen over, it is not navigable as the shores are lined with ice for four or five miles out from the land. "There are two obstructions for which Superior is notorious and they rank next to the ice and still further limit navigation for some lines of ships. These evils are the fogs and the snowstorms. And of these two the fogs are the more numerous and the snows the more dreaded. In the summer, Dame Superior wears her fogs almost as a Turkish wife wears her veils. There is a time in August when the only fogs are those which follow the rain, but the snow begins in September.

The Canadian Pacific steamships are only in service from May to October and it is the snow that curtails their season. It snows on the great lakes as it does on the plains, in terrible flurries, during the course of which it is impossible to see a foot ahead, or to see at all. It has a way of snowing on Superior as late as June and as early as September. As for the fogs, though they are light and often fleeting after midsummer, they are sufficiently frequent during the rest of the season of navigation to have given the lake a bad name among sailors, and I had a captain tell me that he had made seven voyages in succession without seeing any lights on his route from Port Arthur to the Soo."

Great railroad lines extend now from east to west along both shores, the Canadian Pacific on the north and the "Soo Road" on the south. Freight is much cheaper by water than by rail, and the freight rates by water compel the railroads to reduce their rates. "Those who have made the arguments for the various lake ports show that whereas in 1868 the rail rate on grain from Chicago to New York was 42.6 cents a bushel it was 14 cents in 1885. The water rate fell in that time from 25 cents a bushel to 4.55 cents. It has kept from 25 to 67 per cent lower than the rail rate. The value of the water-ways to the public is illustrated in a startling way by making use of the government records of the Sault Ste.

Marie Canal traffic for 1889. There passed through that canal 7,516,022 tons, carried an average distance of 790.4 miles at 0.145 cents a ton a mile. The railroads would have charged 0.976 cents, and the business would have cost the public fifty millions of dollars more if the railroads had transacted it than was charged by the boatmen." This gives some notion of the vast amount of freight on our great inland lakes. Thirty-six millions of tons of freight passed through the Detroit River in one year, which is much greater than the tonnage of the ocean and gulf ports of the entire United States. A study of these trade routes from the Great Lakes to the St. Lawrence and Hudson reveals the chief line of traffic in the United States, as well as between the United States and Europe.

After studying Lake Superior in detail it will be instructive to make a brief comparative study of the other great lakes, their shores and cities, their size and commerce. Any good cyclopedia will furnish sufficient data from which to compare the other lakes with Superior. The chief lake ports should also be studied and compared in their relative importance and advantage for trade. In Tilden's Commercial Geography, pp. 74, 75, is a valuable though brief treatment of the "Nine Lake Ports" (Leach, Shewell & Sanborn, Chicago).

In the later study of geography in America

and in other continents such a knowledge of our great lakes, their extent, scenery, climate, commerce, and cities will be helpful and should be called up again in frequent comparisons.

The Surface of Tennessee.

An examination of the map of the United States will show that Tennessee from east to west includes the whole slope of the Mississippi valley, from the highest summit of the Allegheny range to the bottom lands and swamps of the great river. In Tennessee and Alabama, also, we find the nearest approach of the mountains to the Mississippi.

A study of the surface features of Tennessee not only shows some of the chief varieties of mountain and plain, and their agricultural and mineral products, but gives them in a series of parallel districts. The Tennessee river crosses the state twice from north to south, and with the Cumberland gives the state three distinct valleys, with the mountains or elevated ridges between.

The Valley of East Tennessee is perhaps the most attractive part of the state to visitors and travelers. It extends from northeast to southwest across the state, and is drained by the Upper Tennessee and its branches. It is a long, narrow, valley, somewhat rough and irregular, at its narrowest point not more than seven miles across and widening out to twenty-five miles. This

valley has the range of the Great Smoky mountains, or Unaka range, on the east, separating it from North Carolina, and the lower Cumberland mountains on the west. This long valley is a continuation of the great Valley of Virginia, and was the home of the first settlers under Robertson and Sevier. It is somewhat elevated above the sea, and has a cool and bracing climate even in summer time. During the Civil war this part of Tennessee remained faithful to the union, and was the scene of many battles of importance. Near Chattanooga the river breaks its way through the mountains and turns southwestward into Alabama. At this point are some noble bluffs and deep gorges, through which the river passes, and this was the center of Grant's great movements at one period of the war. Both sides of this valley have abundance of iron ore, and many furnaces have been established for its reduction. Marble is also quarried along the valley, and has been much used in the United States for building purposes: as, for example, in the Capitol at Washington. This great valley has been washed out during long ages by the waters of the Tennessee and its tributaries. The upper slopes of the mountains are covered with pine forests, which yield tar, pitch, and turpentine. On the lower mountain slopes are groves of sugar-maple and other hard wood trees, and red-cedar. The hills and mountain slopes afford abundant pasturage,

but there is only a narrow strip of rich agricultural land. The coal fields also extend along this valley, so that the iron ore can be smelted with coal obtained near at hand.

Between the valley of east Tennessee and the valley of middle Tennessee, with Nashville as its center, are the Cumberland mountains and their projecting highlands toward the west and south This mountain district is not so high as the Unaka range, and while most of the ridges extend from north to south, some are at right angles to this. "The Cumberland mountains stretch across the state from north to south, and in the middle of the state take a westerly direction, gradually diminishing into moderately hilly ridges, enclosing beautiful and fertile valleys. These mountains occupy in some places a breadth of fifty miles, and are a prolongation of the Allegheny range." This district of the Cumberland mountains is really a plateau, rising in places to 3,000 feet, forty miles wide and a hundred and forty long. It is underlaid with the coal measures, and above them lie the later rock strata that were formed above the coal bearing strata.

In the north central part of the state lies the rich and beautiful valley of middle Tennessee through which the Cumberland river flows. Most of the country between the Cumberland mountains and the Tennessee river of the west is hilly and broken, but the valley about Nashville sinks

below the level of the surrounding ridges, and, in fact, is like a great basin with a rim of rocky highlands surrounding it. It is about two hundred feet below the level of the surrounding hills and was selected by the early settlers at Nashville for its fertility and rich promise. The soil of middle Tennessee, as it is called, is generally good, producing large crops of wheat and other grains, hemp, flax, cotton, and tobacco. In this region, also, are splendid forests which have been more developed in recent years than formerly. The poplar, hickory, black walnut, oak, beech, locust, and cherry are found in abundance, both on the lower levels and on the uplands. The lumber industry of Tennessee has grown to much importance.

Nashville, Tennessee, has become noted as a beautiful southern city. It has a number of great schools and higher institutions and the state capitol, as well as a beautiful location on the river.

The district between the Tennessee and Mississippi rivers is more level and is a rich agricultural region. There are some low and swampy lands in the northern part, and along the lowlands of both the Tennessee and Mississippi are extensive canebrakes, with tall canes of great size. The uplands produce cotton, tobacco, and grain in abundance. In the lowlands are large swamp cypress, sycamore, cottonwood, and swamp cedar. Memphis, on a bluff in the southeast of

the state, is a great cotton market. It has been scourged twice with yellow fever, which was brought up the river in boats from New Orleans. Memphis is the chief river port between St. Louis and New Orleans. Much of the cotton collected here is shipped by rail to New York and other eastern cities. A ferry crosses the Mississippi at Memphis and connects with railroads to Kansas City and Little Rock.

The state of Tennessee is naturally a very rich country with great forests, abundance of coal and iron in its hills and mountains. It has also a rich soil and large navigable rivers which make shipments to the gulf or to the Ohio cheap. But since the war the resources of the state have not been rapidly developed until the last few years. Large smelting steel and iron works have been established at Chattanooga and at Knoxville. Mills for the manufacture of cotton cloth have been established also, and northern capital and settlers are helping to develop the riches of the country. Large companies with extensive capital have bought up some of the best forest tracts and are developing the lumber business. Many varieties of excellent marble have been quarried in Tennessee and are shipped to other states.

One of the curiosities of the surface of Tennessee is the great number of deep and extensive caves found in the hilly limestone districts of this state. Several of them are miles in extent under-

ground, with streams of water flowing through them.

Tennessee is as much broken up and irregular in its surface features as any of the states west of the Rocky Mountains. It will be well to have the children not only draw it in outline, locating the districts clearly, but also mould it in sand on the sand table and work out in detail its physical peculiarities, studying the maps for this purpose. The cyclopedias will help the teacher in getting a clearer picture of the surface.

Trip on the Lower Mississippi

from St. Louis to the Jetties at the Delta.

A steamboat trip on the lower Mississippi from St. Louis down to the mouth was formerly much more common and popular than now. The steamer itself is a grand affair with its great smoke stacks from which issue clouds of black. A writer in Scribner's Monthly for October, 1874, thus describes a Mississippi steamer: "The 'Great Republic' is the largest steamer on the river, literally a floating palace. The luxuriantly furnished cabin is as long and ample as a promenade hall, and has accommodations for two hundred guests. Standing on the upper deck or in the pilot house one fancies the graceful structure to be at rest, even when going at full speed. This is the very luxury of travel. An army of servants come and go. As in an ocean voyage, breakfast, dinner, and tea succeed each other so quickly that one

regrets the rapid flight of the hours. In the evening there is the blaze of the chandeliers, the opened piano, a colored band grouped about it and playing tasteful music while youths and maidens dance. The two score negro 'roustabouts' on the boat were sources of infinite amusement to the passengers. At the small landings the Great Republic would lower her gangplanks and down the steep levees would come a procession of negroes and flour barrels. The pilots, perched in their cosy cage, twisted the wheel and told us strange stories."

Up to the time of the war the lower Mississippi was the scene of great steamboat travel and traffic. The invention of the steamboat by Fulton was a great help to the early settlers of the Ohio and Mississippi valleys. Before 1817 there were eight steamboats on the Ohio; in 1829 there were over 200 steamboats on the Mississippi; in 1842 there were 600 steamboats and 4,000 flatboats; in 1847 there were 1,190 steamboats, besides barges and flatboats on western rivers. These figures, though brief, show how trade and travel grew on our western rivers before the age of railroads. Vast quantities of goods were shipped on the rivers east and west, north and south. In 1842 it is estimated that $220,000,000 worth of goods were carried by the boats on western rivers. Emigrants with their families and household goods came west by boat and it was the common mode

of travel for all. There was great rivalry of the companies in building splendid boats, and races up and down the river were common.

A trip in a steamboat nowadays down the Mississippi is not so exciting and trade and steamboat life are not so brisk, and yet such a trip is perhaps the best means of getting some knowledge of our greatest river and the many curious and striking pictures it furnishes.

The main river really begins where the Missouri joins the Mississippi, and together they pour their vast flood down the broad valley. At Cairo, the southern point of Illinois, the Ohio adds its waters to the main stream, and from there on the current deepens, the valley widens, and the tar-like flood winds its crooked course for twelve hundred miles through the soft mud and bottom lands, where no sign of rock is found in bank or bottom, but only the rich silt carried down by the river.

The distance between the bluffs is from twenty-five to eighty or even a hundred miles. From Cairo to Memphis the river hugs the Kentucky shore, leaving the earthquake swamp and sunken lands on the west side in Missouri and Arkansas. Below Memphis the channel crosses the lowlands to the other side and flows past the bluffs at Helena and the mouths of the White and Arkansas rivers. Then further south the current of the river sweeps across the lowlands to the bluffs at

Vicksburg, and does not return to the west bluffs. There are vast swamps and rich bottom lands on the east side between Memphis and Vicksburg. Below Vicksburg there are such extensive low lands, bayous and swamps on the west side. In the bottoms the land slopes down gradually away from the immediate banks of the river so that most of the bottom lands are below the level of high water, and are subject to floods unless the levees can be made strong and high enough to protect them.

Starting from St. Louis down the river in March, we have more than a week's quiet journey to New Orleans. It may be cold and wintry in the north but there are great changes of climate before we reach the end. It grows warmer; we find the fields already plowed and planted in Mississippi, and the trees are green. The swamp oaks festooned with gray moss give the lowlands a dismal look, and at this season the bottom lands may be flooded. In places along the shore of Tennessee we see tall canebrakes, and on the bluffs sometimes two and three hundred feet above the valley are perched the cities.

"A journey of twelve hundred miles was before us. We were sailing from the treacherous March weather of St. Louis to meet the loveliest summer robed in green and garlanded with fairest blossoms. Eight days of this restful sailing on the gently throbbing current and we should see the lowlands, the Cherokee rose, the jessamine, the orange tree."

"Our river pilot must be a man of great nerve and experience, not only knowing the channel and all its twisting courses, but able to detect changes in the shallows and currents, and skillful to guide the vessel even at night. Mark Twain in his 'Life on the Lower Mississippi' has given us a vivid picture of the pilot and of steamboat life at the time of its greatest importance.

"The pilots on the Mississippi and western rivers have an association with headquarters at St. Louis and branches at Pittsburg and other cities. Each of the seventy-four pilots on his trip makes a report of the changes or obstructions in the channel, which is forwarded from point to point to all the others.

"In March and April when the snows and ice are melting and the spring floods come down all the great tributaries of the Mississippi, the main channel below Cairo becomes a mighty torrent. It rises little by little till the levees can scarcely hold it back. These floods are not frequent, but in some cases they have been very destructive, and neither the owners of plantations in the great bottom lands nor the government of the United States have been able yet to control the river at such times of danger.

"When the rains have swollen its tributary rivers to more than their ordinary volume, the Mississippi River is grand, terrible, treacherous. Always subtile and serpent-like in its mode of

stealing upon its prey, it swallows up acres at one fell swoop on one side, sweeping them away from their frail hold on the mainland, while, on the other, it covers plantations with slime and broken tree trunks and boughs, forcing the frightened inhabitants into the second story of their cabins, and driving the cattle and swine upon high knolls to starve or to drown. It pierces the puny levees which have cost the bordering states such vast sums, and goes bubbling and roaring through the crevasse, distracting the planters and sending dismay to millions of people in a single night. It promises a fall on one day and rises suddenly the next. It makes a lake of fertile country and carries off hundreds of wood-piles which patient labor has collected along the banks for the use of passing steamers. It makes islands of towns perched on the banks. As the huge steamer glides along on the mighty current we can see families perched in the second stories of their houses. At one point a man was sculling along from house to barn with food for his stock. The log barn was a dreary pile in the midst of the flood. The swine and cows stood shivering on a pine knoll. As we passed below the Arkansas and White rivers, the gigantic volume of water had so far over-run its natural boundaries that we seemed at sea instead of upon an inland river. The cottonwood trees and cypresses stood up amid the watery wilderness like ghosts. Gazing into the long avenues of the

sombre forests we could see only the same level, all-enveloping flood. In the open country the cabins seemed ready to sail away, though their masters were usually smoking with much equanimity and waiting a 'fall.'"

The levees built along the bank to keep the water in the main channel and prevent overflow begin above Cairo. This city is built on a flat, low plain, below the level of high water. The levees are strong at this point, so that the water does not flood the town, but it seeps through the banks and covers the lower ground, making it possible to pass through some of the streets in boats. The levees are designed not only to prevent the floods sweeping into the lowlands, but by confining the current they are expected to cause the waters to scour out a deeper channel. Before the war, when the planters were richer and could control their laborers to better advantage, the levees were better kept up and the lowlands protected; but since the war there have been several destructive floods, doing millions of dollars worth of damage. There is a levee extending most of the distance from Cairo to Vicksburg, on the east side. The national government has spent a good deal of money in surveying the river and in building and protecting the levees. One chief difficulty is the fact that the levees themselves have to be built of the soft mud and dirt, which the current of the river so easily washes away, and

the river is constantly eating into its banks and washing away at times whole acres of land.

Several of the most important cities we pass upon the steamer are situated high on the bluffs at the foot of which the river flows. The first of these is Memphis, on the fourth Chickasaw bluff, and not only holding a commanding position on the bluff, but a great center for the Mississippi trade in cotton and tobacco. It is also an important railroad center, because of its railroad connections with the west and southwest, and with the east.

Vicksburg, another "hill city," is on a great bend in the river. The steep streets run up to the terraces and bluffs and the city presents an imposing sight from the river. The bluffs run back to a higher plateau back of the city, and many fine residences are seen on the higher terraces. The old court-house occupies one of the highest levels, and the old fort, with its grass-covered ramparts, still stands on an eminence commanding the river and bears marks of the memorable siege. From this old fort, high upon the bluffs, one can see the great bend in the river, the passing steamers and ferries, and the lowlands of the great loup, almost covered in high water. During the siege of Vicksburg, General Grant tried to turn the channel of the river at the time of the spring flood. In this he failed, but in later years the river itself made a cut-off, leaving the city of Vicksburg several miles away from the main chan-

nel. At the mouth of the Yazoo river is the great national cemetery where sixteen thousand soldiers lie buried, and twelve thousand of the graves are marked "unknown." Trees are planted, the grounds are kept tastefully in honor of the soldiers who fell in the south. Oak trees have been planted and have grown upon the spot, and vines have clambered upon them. A small marble monument marks the spot where Grant met Pemberton. Vicksburg was formerly the center of a great steamboat trade with New Orleans, and is still important for the cotton trade.

Natchez also stands on high bluffs overlooking the river. It is one of the loveliest of Mississippi towns and was once the home of great wealth and of many cultured families. That part of the town at the foot of the bluffs along the water is known as "Natchez under the Hill," where the steamboats load cotton. The steep road leading up the high bluff brings us to a beautifully shaded, quiet town with rich and cultured homes. Before the war this was a favorite residence of many important families, and now these old homes may be seen in the midst of abundant trees and blossoms. "In the suburbs, before the war, were great numbers of planters' residences—beautiful homes with colonades and verandas, with rich drawing and dining rooms, furnished in heavy antique style, and gardens modeled after the finest in Europe. Many of these have been destroyed, but we vis

ited some still preserved. The lawns and gardens are luxurious, the wealth of roses inconceivable. I remember no palace garden in Europe which impressed me so powerfully with the sense of richness and profusion of costly and delicate blooms as Brown's garden at Natchez. It was also on the bluffs at Natchez that the Indians in olden time kept the sacred fire ever burning, but which went out when the white men came."

Two other great rivers besides the Missouri come into the Mississippi from the west, the Arkansas above Natchez and Vicksburg and the Red River below. The Arkansas comes all the way across the plains two thousand miles from the Rocky Mountains of Colorado. It is a fine river and is navigable to the Indian Territory. The Red River is also important for steamboat traffic. Formerly a great raft of drift wood, thirty miles long, obstructed the boating above Shreveport. But government engineers succeeded in breaking it up and in opening up a passage for boats. At the time of spring floods these rivers also add their volume to the Mississippi and increase the danger of overflow.

New Orleans, the chief city of the lower Mississippi, is built on a great bend in the river on lowlands sloping back from the high levees. The levee at New Orleans is crowded with steamboats loading cotton bales and barrels of sugar and unloading the cargoes from Europe and from the At-

lantic coast. Fruits and tropical products are landed from the West Indies and South America. New Orleans was originally settled by the French and many French names and families are still met with. The great French market with its sheds and booths, fruits, flowers, and fish, is one of the peculiar attractions of this metropolis of the South. The cemetery is a beautiful park in which palm trees, bananas, magnolias, and other fine Southern trees abound. The graves are marble vaults built above the surface, as the ground is so low and saturated with moisture that graves are not dug. At New Orleans was fought the famous battle at the close of the war of 1812 in which Andrew Jackson defeated the British.

The commerce of New Orleans and of the lower Mississippi was hindered for many years by the bars of mud formed at the mouths of the river. An examination of a good map of the river below New Orleans will show clearly that the water of the Mississippi has carried down a great deal of mud and built up new land far out into the Gulf of Mexico. In forcing its way through the mud that has collected at its mouth the main current breaks up into three channels called the Southwest Pass, South Pass, and Pass a l'Outre. The flat, marshy land and water about these three mouths are known as the delta. "The river at the head of the passes finds its way to the Gulf of Mexico through three different channels. The

Southwest Pass, the broadest and deepest of them all, trends to the right and Pass a l'Outre, the next in size, to the east, while between these two and more directly in the course of the river is the South Pass. The river just above its sub-division is a mile and three-quarters wide, forty feet deep, and carries every minute, when at flood, 72,000,000 cubic feet of water to the Gulf. Every cubic foot of this vast volume of water contains nearly two cubic inches of sand and mud. Enough earth matter, it is estimated, is annually thrown into the Gulf to build a prism one mile square and 268 feet thick. At the mouth of each pass is a bar, over which there is more or less depth of water." It is not a narrow ridge of mud, but a broad, flat bar of sand and mud four or five miles across. "At Southwest Pass the depth of water on the bar is about thirteen feet, at Pass a l'Outre it is ten feet, at South Pass, before the construction of the jetties, it was eight feet. The crests of these bars are not immediately at the end of the land, but from two and a half to five miles out in the gulf. Through the whole length of the passes there is a deep channel (uniform for each pass) about 1,200 to 1,500 feet wide in the two large passes and 600 feet wide in South Pass, and the depths are about 50 feet in the large passes and 35 feet in the South Pass." As the water goes down through the passes it has a swift, boiling current and scours out a deep channel and carries its mud and sand

with it. But when the rushing current reaches the broad, shallow expanse of water at the mouth, it spreads out and becomes sluggish so that the silt settles to the bottom. In this way these broad, flat bars are formed and kept constantly extending into the gulf. In the South Pass 100 feet per annum, in Southwest Pass over 300 feet per annum, were built up. These shallow bars at the mouths of the river were a great obstruction to ships going in and out. Dredging boats were used constantly to deepen the passage at Southwest Pass, at an expense to the government of $250,000 a year, but even then they could not secure a depth of more than eighteen feet and often less. All large vessels, therefore, were hindered from passing the bars.

"In 1859 a committee from the New Orleans Chamber of Commerce visited the Southwest Pass, and found the bar blocked with a vessel while fifty-five other vessels were waiting to come in or go out. Some of these vessels had been there for weeks waiting for a chance to go to sea." Vessels of more than 700 tons burden could not pass the bars, but the average vessels of the Atlantic seaboard carried from 1,200 to 1,800 tons.

It was extremely important therefore to the commerce of New Orleans and the South to find some means of securing a deep channel to the gulf.

In 1874 Captain James B. Eads appeared before Congress at Washington with a plan for building jetties and deepening the current at the mouth of the river. He did not have the means for carrying on such an expensive undertaking, but he agreed, if Congress would furnish the money, to secure a channel thirty feet deep and to receive no pay for his own labors till this result was accomplished. Many of the ablest engineers were directly opposed to Captain Eads' plan, but he explained his ideas so forcibly that Congress, in March, 1875, passed a bill authorizing him to make the attempt. Captain Eads desired much to make use of the Southwest Pass because of its greater depth and current, but he was compelled by Congress to make the attempt in South Pass.

His general plan was based on the idea of letting the river scour out its own channel and even cut a deep passage through the bar beyond the mouth of the pass. Beginning at the upper end of South Pass he began to build a line of jetties on each side of the channel, forming thus new banks, narrowing the current of water, compelling it to flow faster and scour deeper the channel of the pass. First a row of piles was driven down along each side of the pass, but in the water at some distance from the shore. In some places the piles were driven in water thirty feet deep. It was found that these piles formed a firm and sub-

stantial barrier against which to build up the jetties. The piles were driven into the mud at the bottom of the channel by means of steam pile drivers. This double row of piles extended in a curve along the sides of the channel of the South Pass and across the bar two and a half miles beyond to the open waters of the gulf.

The jetties themselves which were built along these lines consisted of great willow mattresses, from twenty-five to forty feet in width and a hundred feet long. "The jetties are constructed principally of willows. These trees grow in great abundance about twenty-five miles up the river, and vary in size from one to two and a half inches at the butt, and from fifteen to thirty feet in length."

The willow mattresses were constructed by Captain Eads on the following plan: "Along the bank of the pass were built inclined ways at right angles to the shore line and extending back from the river bank about fifty feet. The inclines are so constructed that while the ends of the timbers are under water at the river they are about six feet above the level of the water at the other or shore end. These timbers are spaced about six feet apart, and are parallel with each other. Boards below hold these timbers firmly in place. The ways are now ready for the mattresses which are built in the following manner: Long strips of board, two and a half inches thick and six

inches wide and from twenty-five to forty feet long, are laid across the slanting timbers, and spliced together until about a hundred feet long. If the mattress is to be forty feet wide nine strips are used and five feet apart. Holes are bored in these strips one and one-eighth inches in diameter and five feet apart. Hickory pins whose ends have been turned to fit the holes tightly are driven into these and wedged and nailed tightly. The pins stick up about thirty inches long. Some of the workmen now climb upon the willow-barge and pass the willows down to the other workmen, standing on the frame, who place the willows in a layer about six inches deep across the strips of the frame. Then a second layer of willows is placed at right angles to the first, and so on till the willows stand above the tops of the pins.

In placing the willows the bushy tops project three or four feet beyond the frame. The men then bore holes in other strips about forty feet long, and place them across the mattress, and insert the pins into the holes, pressing down the cross strips with levers. Wedges and pins are driven into the ends of the pins, and the mattress is done and ready for launching. The mattress is easily pulled off the ways by means of a steam tug, which tows it to its place along the jetty piling. A barge, loaded with rock, is then placed alongside the floating mattress, and the stone distributed evenly over it until it sinks to the bot-

tom. The foundation mattress is usually from forty to fifty feet wide, according to the depth of the water. The courses above it become narrower and narrower until they reach the surface of the water, where the average width is twenty-five feet. When the mattresses are sunk into the river all the interstices fill very quickly with sediment, which serves not only to hold it more securely in place, but makes it much more impervious to water." A row of these mattress jetties was thus built on each side of the channel of South Pass, narrowing it to about 1,000 feet.

"When the jetties were nearly constructed, it was decided to build temporary spurs or wing dams at right angles to the jetties, extending into the channel about one hundred and fifty feet. These wing dams narrowed the channel from a thousand to about seven hundred feet. The objects in constructing these wing dams were: first, to locate the deep water channel midway between the jetties; second, to hasten the channel development; third, to induce a deposit of sediment and an incipient bank formation along the channel side of the jetties. These wing dams were spaced about six hundred feet apart. They were built by driving a row of piles out from the jetty line and resting the mattress against them, placing it on edge."

One of the greatest difficulties was to produce a deep channel through a large shoal at the head

of South Pass. In order to produce a current into South Pass strong enough to scour out a channel through this shoal, dikes and dams were run up from the head of South Pass to raise the water and secure a more rapid fall. At first the result was to turn the water into the other passes, but great wing dams of mattresses were built across the channels of both larger passes which had the effect of raising the water in all the passes and in giving such a rapid flow through the shoal as to scour out a channel forty feet deep.

From the very beginning of the jetty building the effect could be seen in South Pass by a deepening of the channel. As the jetties progressed toward the bar the channel across the bar gradually deepened from mouth to mouth. From May, 1875, to July, 1879, the work went steadily forward. At the end of this time there was a channel thirty feet deep from the deep water in the river to the deep water in the gulf. It was 700 feet wide at the surface and 200 feet wide at the bottom. To form this channel through the bar required the removal of 5,500,000 cubic yards of material which has been washed out by the current into the gulf. Captain Eads also constructed a very large dredge-boat which was used to help deepen the channel in a few of the shallow places.

"At the outer end of the jetties, where they projected beyond the bar into the gulf, there was

danger that the violent storms which beat against these shores at some seasons, would destroy the works. To prevent this, a heavy line of stone and concrete was built out along the jetties.

"At distances of every fifty feet near the outer end of the work are built spur cribs, about twenty feet square, filled with rock, upon which a solid concrete block is built. Flanking the work at the extreme sea end are massive cribs of palmetto logs, filled with riprap and surmounted with larger rock."

The success of this great enterprise brought good not only to New Orleans but to the whole Mississippi valley. It is estimated that the jetties, by partially improving the channel of the river, saved the country $1,600,000 during the year ending September 1, 1878, by the reduction in freights on cotton alone.

Before leaving the study of the Mississippi valley, the whole river with its tributaries should be sketched, the different producing regions located, the chief marts pointed out and compared, the contrasts of climate and production noted, and the different kinds of populations and of occupations clearly perceived. This extensive valley, with its network of rivers and variety of producing regions, is a great, complex type of a river valley with which to compare other great river valleys of the world.

COTTON AND THE COTTON PLANTATIONS.

Cotton was a native plant, used by the Indians for making cloth in Mexico when Columbus first came. The sea-island cotton came from Honduras, and the cotton plant of the Southern States probably from Mexico.

In many of the southern states, like Mississippi, Alabama, and Texas, cotton is the one great and important crop. The large plantations are almost exclusively devoted to raising cotton. When a good crop is sold at fair prices it enables the planter to purchase all the necessaries and comforts of life, but if the crop fails the planter is brought almost to ruin. The growth of cotton-raising in the South is remarkable.

In 1820 the entire crop of the United States was 455,000 bales. In 1891–2 it was 9,035,379 bales, of which 65 per cent was exported, valued at nearly 225,000,000 of dollars. Texas had 2,400,000 bales, and next Mississippi, Georgia, Alabama, Arkansas, Louisiana, South Carolina, Tennessee, and North Carolina, in order. Also, 4,500,000 tons of cotton seed were used. The oil from cotton seed is pressed out and much employed instead of olive oil for table use, for soap making, etc.

A good description of a large cotton plantation in the South would give us one of the most interesting and characteristic pictures of southern life. The residence of the planter, with its

broad verandas, stands in the midst of his extensive fields. The barns and gin houses are near at hand and the log huts or cottages of the negro laborers. The work of raising and gathering the cotton crop lasts from early springtime till the frosts of autumn and then follows the ginning and shipping.

The ground is plowed in March in preparation for the cotton crop, and the planting begins in April. The rows are placed three feet apart in hilly ground, and four and one-half or five feet apart in rich bottom land, where the plant grows larger. The seed is put in with a drill, quite thick, but after it is up a few inches it is thinned out so that the single stalks stand a foot or a foot and a half apart, according to the richness of the soil. A plow is run between the rows and the dirt is hilled up along the stalks. Until some time in July the fields are cultivated with plow or cultivator and then the long rows are hilled up for the last time. Good showers once in two weeks, and warm weather are needed to produce a good crop. Too much dry weather or too much rain spoil the crop. Early and late frosts are also a damage to the cotton plants.

There are three kinds of worms that often destroy the cotton plants; the cut-worm eats off the young sprout down to the root, the boll-worm gets into the cotton boll and destroys the cotton, and, worst of all, the army-worm comes in August and strips the plant of leaves and cotton bolls.

"The growth of the cotton plant is rapid. The sprout appears within a week after seeding and by June the flowers come out; white on the first day, red on the second, and on the third falling off, leaving in their place the tiny boll in which lie the hopes of the planter. If all goes well, this grows larger until ripe, when it opens and the cotton hangs out. The opening process lasts until the first sharp frost kills the plant, which, in a late crop, may happen before half of the bolls are ripe. Generally a field is well opened by late August or early September and then the pickers begin work. Early in the morning the farm wagon is driven into the field road, loaded with a stock of bags, which are scattered along in piles; each picker ties one by a strap over his shoulder, so as to bring the mouth of the bag under his arm, and, with the other end trailing on the ground, starts in between the rows, snatching the cotton out of the bolls and thrusting it into the bag till filled, when he drags it back to the road, takes an empty one, and starts again into the field. The quickness with which a skillful picker will strip a plant is astonishing; when the cotton is not too scattering he will get nearly two hundred pounds a day, and none but those who have tried the experiment of picking cotton know what this means. These field hands are paid at the rate of from fifty to seventy-five cents per hundred pounds. Both old and young take part in the work and alike will

bear sunshine and heat with no sign of fatigue or distress; but it is almost impossible to get them into the field if the weather becomes damp and chilly."

The loads of sacks are brought to the gin house or place where the cotton fibres are separated from the seeds. Before the invention of the cotton gin it kept one person busy a day to separate a pound of cotton from the seed. But after the invention of the cotton gin three hundred pounds could be separated in a single day by a single machine. The story of Whitney's difficulties and successful invention will be found in a good cyclopedia or history. The gin itself has a revolving cylinder with nine-inch saws half an inch apart; each saw passes between parallel wires seizing the threads or fibres of cotton and pulling them through but leaving the seed; quickly revolving brushes sweep the cotton from the teeth of the saws and a blast of air drives the cotton to a condenser and cleanses it of dust. The cotton room of the gin-house is an interesting place with its great piles of snow-white cotton.

Before shipping, the cotton is piled into a heavy press, wrapped in a stout bagging, tightly pressed, and narrow strips of iron clasped round the bale and fastened. This is the press room, and the workmen are grotesquely covered with cotton, as in the gin house. The cotton bales, weighing five or six hundred pounds, are hauled to the steam-

boat landing where the stops are regularly made by the steamboats to take off the cotton. It is then carried to New Orleans or Memphis, whence it is shipped by water or by railroad to the eastern factories.

The cotton seeds were formerly of no use, but now they are put into presses where the oil is squeezed out, and, when purified, it is much used in soap making and instead of olive oil. The cotton seed cake, which is left after the oil is pressed out is also used as a fodder for cattle.

The great cotton manufacturing cities are in New England, such as Fall River and Lowell. Much of the raw cotton is shipped to Boston and New York, whence it is sent to the mills. More than half of all the cotton is exported to England and Europe to be used in their factories and then sent out over the world. In recent years a number of factories have been established in southern cities, as at Richmond, Atlanta, Columbia, etc., where the cotton can be manufactured into cloth without shipping the cotton.

The cotton belt stretches from North Carolina to Texas, and from Kentucky to the gulf. The climate is hot and negroes perform most of the field work. The planters engaged in the cotton production depend upon the sale of cotton for everything with which to carry on the work of the plantation. They scarcely raise the corn and vegetables necessary for plantation use. When

the price of cotton is low, or a bad crop comes, they often have to run in debt or sell their farms.

The chief cities where cotton is collected and shipped are Galveston, New Orleans, Memphis, Charleston, Savannah, Norfolk, and New York. The railroads have now become very important in shipping cotton. Reference Scribner's Monthly, 1874.

Since the war the cotton planters of the South have had great difficulty in making the business pay. The negro laborers are not so easily controlled as when they were slaves, wages are high, and many rich lands in Texas and Arkansas have been planted in cotton, so that there has been over-production of cotton and low prices. The cotton-planters have been urged to raise other crops, as corn, vegetables, grain and fruit, and to feed hogs and cattle for their own meat supply; but they have been slow to adopt a variety of crops and have depended too much on cotton. The old cotton plantations, many of them, have lost their productiveness because there was no proper rotation of crops, and the negroes, who are fitted to do most of the work, have not yet learned to be thrifty and industrious.

Irrigation and the Big Ditch at Denver.

The city of Denver lies in the valley of the South Fork of the Platte River about twenty-two miles northeast of the point at which the river

emerges from the foot-hills and starts northeastward across the plains to join the north fork of the Platte and move eastward to the Missouri. About twelve years ago the big irrigating ditch was dug so as to draw its waters from the south fork of the Platte and distribute them along the gentle slope southeast of the river. About forty miles south of Denver is a plateau extending out from the mountains into the plains and forming a divide or water-shed between the Arkansas on the south and the Platte on the north. For many miles, therefore, the plains slope gently from the divide toward the northwest down to the south fork of the Platte. This gently sloping plain is a part of the region known as "the Plains," lying just east of the Rocky Mountains. It is a dry, treeless land with a scanty grass and cactus growth. The soil is sandy but rich and, if well supplied with water, produces excellent crops of grain, grass, and vegetables. But the rainfall for the whole year is very light and cannot be depended upon for crops, while even the thin buffalo grass will feed only a small part of the stock of one of our meadows of equal area. The early settlers in Colorado were either miners or grazers and stockmen. But as cities and towns sprung up along the mountains, agriculture along the river valleys began to attract attention and the water was drawn out from the rivers and streams into ditches to irrigate the growing crops.

The first ditches were small and were taken out by a few farmers whose land lay in the bottoms and near the rivers. Some twenty years ago a larger ditch, called the City Ditch, was taken from the river at Littleton, ten miles south of Denver, and carried along the slope back from the river toward Denver. It passed just east of the city and along the plain above, so that its water was drawn off not only for farms but to run through the streets of Denver to water gardens and the cottonwood and maple and other trees which shaded the streets of the city.

With the great increase in population at Denver and all along the mountains, in mining towns, the demand for agricultural products became greater, and as they had to be shipped from Kansas or Utah, three or four hundred miles, the impulse became strong to bring much larger territories under the irrigating canals. About fifteen years ago a wealthy company secured the privilege of constructing a great irrigating ditch so as to bring in a large part of the southeast slope of the Platte river under water, and thus open up a strip of irrigation many miles long and from two to twenty miles wide.

In order to get the water at a high level and thus carry it as far back upon the plains as possible, a dam was built in the river three or four miles up the cañon, which the river has cut through the

mountains before coming out into the plain. A heavy framework of timbers was built across the stream and boarded up so as to make a solid dam, and from it boards were sloped down on the lower side over which the excess of water flowed. The big ditch was taken out of the river from the side of the dam much as a mill race is taken from a stream. A way was made for this artificial canal along the cañon three or four miles till the mouth was reached. But the cañon is narrow in places and crooked, and lined with mountains from five hundred to one thousand feet high. In one place it was necessary to cut a tunnel out of solid rock five hundred feet through a spur of a mountain, through which the canal flows. In several places where the cañon is narrow and the sides steep, with rocky cliffs, a great wooden trough was built along the side of the mountain and supported by heavy braces, and the water carried through this. As the descent of the river is much more rapid than that of the canal, at the point where the river and canal emerge from the mountain, the canal is twenty or more feet higher than the current of the river. At this point the canal diverges from the river, and is carried back as far as its elevation, and a gentle slope so as to produce a current, will allow.

After the canal is brought out of the foot hills and away from rough, hilly country near them to the more regular slope of the plain we may get a

more accurate notion of its size. The digging of this great ditch required the work of hundreds of men with horses, scrapers, and other machines. The canal is forty feet wide at the bottom and seven feet deep when the water is turned on. The dirt as it was taken out was thrown mostly upon the lower side toward the river, so as to form an embankment on that side. In many places the dirt was piled up fifteen or twenty feet high, and the cuts resembled a great railroad cut, only wider. The work of excavation was carried on for months along this line with many men who lived in tents and with much expenditure of capital.

A number of ravines and gullies had to be crossed as the ditch was extended. From the high divide streams of water come rushing down to the Platte in the rainy season. During most of the summer these gulches are dry. Cherry Creek, which enters the Platte at Denver, is a large stream in the rainy season but nearly dry during the summer. Its valley is half a mile wide and twelve to twenty feet below the level of the plain. The big ditch had to be carried across all these gullies and valleys. Generally the ditch is brought to the edge of the valley and carried over a large wooden trough to the other side. This trough or flume must be deep and wide enough to carry the full stream of water. It is built upon piles and wooden trestles like a rail-

road bridge. The seams and cracks between the boards are calked up so as to cause as little leakage as possible.

In some places dams are built across the valleys and the water run in so as to form a large lake or reservoir extending some distance back up the valley. Sometimes the water is run onto tracts of low level land and a bank extended along the lower side, forming a shallow lake. These reservoirs are filled with water during the rainy season when the showers fall in April and the snows melt on the mountains. At this season the rivers are usually flooded for a short period and an immense amount of water escapes down the river unless it is stored up in the reservoirs. If stored up it will prove very valuable later during the long dry summer when there are few or no rains. The mountains are the original reservoirs of moisture. Much more snow and rain fall in the mountains than on the plains. The cold mountain sides attract the clouds and moisture and it is condensed into rain and snow. The mountain peaks have frequent rain storms and snows when no moisture falls upon the plains. The forests and other vegetation in the mountains also help to hold the snow and moisture. But in spite of all this the rivers do not furnish enough water to supply all the ditches taken from the river. The best way to increase the water supply so as to be able to irrigate large tracts of country

is to collect in reservoirs the waters which are so abundant at the time of the spring freshets.

When the big ditch has been liberally supplied with water, it can be drawn off through wooden boxings to irrigate the separate fields. Usually a larger boxing lets out enough water to form quite a good sized ditch, from two to six feet across. This may skirt the edges of a number of farms, and from it the water is turned off in smaller channels still to the separate farms and fields. The boxing through which the water escapes from the main ditch passes under the embankment on the lower side. At one end it is below the level of the water in the ditch; at the other end is an upright slide or board, which by being lifted lets out the water, or by dropping it and throwing loose dirt about it in the boxing the flow of water is stopped. Regular officers, or water inspectors, are appointed by the ditch company to pass along the ditches daily and regulate the amount of water sent out to the different farms, to keep watch of the ditch, reservoirs, banks, and flumes and see that all are kept in good repair. Sometimes, in case of rains and freshets, there is danger that the ditch may fill up and overrun its banks, thus wasting the water and ruining the crops. In such cases the water is often turned out at the flumes and allowed to run down the valleys to the Platte.

The fields are irrigated in different ways. A

wheat field or meadow is sometimes flooded, that is, the water turned on till the whole area has been overflowed and soaked. In a cornfield the water is often run down a small stream between each two rows and allowed to soak into the ground till all is moistened. When sufficient moisture is secured, the mouth of the ditch is closed up with a shovel of dirt, and for a week or two, perhaps, the ground may not be flooded again. Most of the land slopes so regularly and evenly toward the river that it is possible to irrigate it all and not allow the soil to wash down.

The ditch company usually sell the water to the farmers by the inch, the amount of water passing through a hole an inch square being sufficient to irrigate an acre. The cost of an inch of water is from $1.50 to $2.50 an inch. If the ditch company owns the land it is leased at a rental for water rights. The ditch company, having spent large sums of money in constructing the ditch, must get its reward in the form of water rent from the farmers.

The effect of bringing a district of country under irrigation is very striking. Fields of grain, meadows of alfalfa, and other grasses, corn, and vegetables grow in abundance. The country that once had much the appearance of a desert is clothed with varieties of green. Shade trees and orchards are planted and thrive, houses and barns built, and the whole country takes on much of the

appearance of a blooming Illinois prairie in spring time. The whole ground becomes so saturated with moisture that wells are dug and supply abundance of water so long as the water in the ditch remains. In the fall and winter the ditches are usually allowed to run dry, as the water is not needed. Land lying below the level of the ditch becomes worth forty or fifty dollars per acre, while just as good land above the level of the ditch and perhaps only a few rods away is not worth more than five or six dollars an acre for grazing purposes. Of course roads are opened and bridges across the ravines are built, and the markets of Denver and other towns supplied with abundance of vegetables, small fruit, and grain. It is claimed by those who farm by irrigation that it is a more reliable and satisfactory method than farming in Illinois or Iowa where dependence must be placed upon the natural rain fall. Sometimes the rains do not come; sometimes they are too abundant and they are not sufficiently regular; but in a country cultivated by irrigation the water can be turned on when needed and in the quantity desired. The abundant sunshine also helps to ripen the fruits better, gives them a better color and flavor. On the other hand, it can be said that only a small part of the Western country can ever be irrigated, as there are not sufficient rivers nor supplies of water for the needs.

There is also constant conflict as to water rights. The old ditches first taken out have the prior claim upon the water. According to the law they have the first claim. The big ditch at Denver, though taken out much higher up the river, is not allowed to take so much water as to leave the old ditches further down the stream without supplies. But it is very difficult to regulate such a thing as flowing water and do justice to all parties.

The northeast slope of the Platte River is supplied with water in a different way. Quite a number of small streams come down out of the mountains and foot hills and move eastward across the slope to join the Platte. Between the river and the mountains at Denver, this rich level or rolling plain is about ten miles wide, and is a garden of beauty and abundance. These small mountain streams are dammed up at favorable points so as to form ponds or lakes; from one of these reservoirs the water can be carried in small ditches to the level fields a little lower down. As one stands on the mountain, fifteen hundred feet above the level of the plain, he can count scores of these small artificial lakes which preserve the abundance of water of the spring season for the use of the farmers in summer time.

It is a matter of much importance to the farmers along the river valleys that the forests in the mountain slopes be preserved so that the snows

and rains may be kept in reserve along these slopes. All through the mountains the woodsmen and the saw-mills have been at work cutting out the best pine timber for use in building: It is quite important that the forests be preserved, and the springs in the mountains be kept flowing. It is also well to encourage the grasses and grass lands upon the mountain slopes and in the valleys, as they, too, help to keep the mountains a permanent reservoir of the rains and snows.

An examination of a large map will show how many streams there are flowing eastward from the Rocky Mountains across the plains that may be found useful for the purposes of irrigation. Even such a large stream as the Arkansas has been used very extensively for the purpose of supplying large irrigating ditches. The upper valley of the Rio Grande is a beautiful and fruitful region, made so by irrigation.

It may be well also to study the map, not only locating the principal rivers and their tributaries flowing down to the plains, but notice also the line in Central Kansas and Nebraska which separates the arid region of the West from the prairies and rainy country to the east, where crops may be raised without artificial means.

A line drawn through Central Kansas and Nebraska from north to south on the 100th meridian would fairly separate the arid region of the West from the rainy regions of the East.

It may be noticed briefly here, also, that most of the Western states and territories must depend in the future for their agricultural development upon irrigation. The fruitful valleys of Utah and California depend upon this means of supplying moisture to the fields.

In some of the states, like Dakota, resort has been had to artesian wells, and this method may fairly be compared with the other means of supplying water to the growing crop.

The study of irrigation as given in the preceding sketch, not only gives an insight into the methods of agriculture in nearly half of our own domain, but it will be found very helpful in explaining similar conditions and agriculture in Africa, in Mexico, and in Central and Western Asia, where the water from rivers is and has been so much used in aiding the cultivation of the soil.

Pike's Peak and Vicinity.

Pike's Peak is the central mountain of a group or cluster of mountains which together constitute a spur of the main chain of the Rockies, extending eastward into the great plain. For this reason Pike's Peak was first seen by the emigrant trains coming from the east, and is still one of the prominent landmarks for those traveling toward the Rocky Mountains. It is surrounded by other peaks and ridges which rise far up into the clear sky of Colorado, but all are dwarfed by the

greater altitude of the central peak. It is about seventy miles south of Denver, and its snow-covered summit can be clearly seen from Denver nearly every day in the year. Except on cloudy or foggy days, which are rare in Colorado, it can be seen as plainly as if it were only ten miles away. Fifty miles to the south of it is Pueblo, the city of smelters on the Arkansas, eastward of the Royal Gorge, where the river breaks through the mountain ridge. Pike's Peak stands, therefore, like a huge sentinel, with the wilderness of mountains and park lands at its back and the great level plains at its feet to the east, and the main ridge of the Rocky Mountains a little back but flanking it on the north and south.

The summit of Pike's Peak rises 14,140 feet above the sea level, but the great plain at its base is 6,000 feet above the sea, and the peak, therefore, rises only about 8,000 feet above the general level of the surrounding country. The peak was discovered and explored by Colonel Pike in 1806, and received its name from him. When gold was discovered in Colorado in 1858, the Pike's Peak gold region became famous, though no gold was mined in its immediate neighborhood.

The peak itself is not a pointed pinnacle but a great rounded swell of the mountain ridge, steep and rocky on some of its edges, but with long slopes and spurs reaching out toward the neigh-

boring mountain masses. But its sides are seamed with mighty gorges and chasms, glittering with snow and ice. During the greater part of the year the peak is plainly distinguished from the neighboring cones by its greater height and its white, snow covered top and sides. "The summit is nearly level, embracing about forty acres, and composed of angular slabs and blocks of coarse, disintegrating granite. It affords one of the grandest views on the North American continent, extending nearly 150 miles in all directions." But it is only occasionally that the tourist can get such a clear view from its summit. But to survey at one sweep a country larger than the state of Illinois is worth the trouble of a mountain climb. Although Colorado has a dry, clear atmosphere and rain is infrequent the mountain peaks are often wrapped in clouds. The higher ridges and peaks draw the clouds and moisture, though the plains at their feet may be clothed in constant sunlight.

But Pike's Peak itself is only the most prominent among a large group of noteworthy objects in this neighborhood, among which are Manitou and Colorado Springs, The Garden of the Gods, Cheyenne Cañon, Monument Park, Glen Eyre, The Cave of the Winds, besides the foot-trail and the railroad to the top of Pike's Peak and many other mountain resorts and scenic wonders. Many thousands of people visit the Pike's Peak coun-

try every year to enjoy the great number of nature's grand and beautiful works.

Just east of the foot of the mountain on a level plain, 6,000 feet above the sea, stands the beautiful city of Colorado Springs, with its shaded streets, fine hotels, and great number of summer homes. Many rich people have built villas and costly cottages for summer residence. Electric street car lines reach to Manitou and Cheyenne Cañon. Six lines of railway run into Colorado Springs, bringing tourists from all directions. It has become, therefore, in connection with the various mountain resorts, a great center for pleasure and health seekers from all parts of the United States.

About six miles west of Colorado Springs is Manitou with its mineral springs. It lies in a deep narrow valley at the foot of Pike's Peak with lofty mountain slopes on either side, a mountain stream passing through its center, and the snow covered top of the peak seen through a notch in the lower mountains. Beside the mountain stream, in the midst of the town, is a park with mineral springs, where thousands of tourists drink for health or for curiosity. "Manitou lies in a cup-like glen, surrounded by mountains, and has for an impressive background, high above the surrounding summits, the impressive majesty of Pike's Peak. Its regular inhabitants number perhaps 1,500 or 2,000. There are two electric

light plants and three miles of streets lighted by the arc light; a beautiful avenue eighty feet wide runs through the village. On either side of this avenue, on the mountain side may be seen many mansions, villas and cottages. In the very center of the town are the springs, enclosed within pleasure grounds, sparkling and bubbling from their hidden reservoirs. Hotels there are in profusion; boarding houses, cottages, almost any kind of retreat or home for a traveler." There are also arcade paths, secluded nooks, smooth curving drive ways, cool and shady parks, hanging rustic bridges, paths up the mountain sides, and lookout points hundreds of feet above the valley. More than 150,000 people are said to visit this spot every year. Farther up the cañon toward the foot of Pike's Peak are iron springs and hotels on the mountain side. Instead of living in hotels or cottages, some people bring tents and camp out along the lower slopes. From Manitou the old trail leads twelve miles to the summit of the Peak. A carriage road now also reaches the top. But more comfortable still, a cog-wheel railroad ascends the mountain from Manitou and puts the summit within easy reach of all.

A little north of the road from Colorado Springs to Manitou lies that region of curious wonders known as the Garden of the Gods. It consists of steep, towering rocks rising hundreds of feet into

the air, some red like terra cotta, some nearly white, with here and there curiously fantastic shapes like bears, or elephants, or other animals. As we enter the Garden of the Gods, we "pass in between massive portals of rock, of brilliant terra cotta red, and enter upon a plain, miles in extent, covered in all directions with magnificent isolated masses of the same striking color, each lifting itself against the wonderful blue of the Colorado sky with great distinctness " It seems as if giants had been at some rude sport and had piled up these immense slabs as if to astonish the puny race of men. "Here a battlemented wall is pierced by a round window; there a cluster of slender spires lift themselves, beyond a leaning tower starts upward and a cube of rock as large as a dwelling house is balanced on a pivot-like point at the base, as if a child's strength could upset it." In the background of all this is the great mountain wall with the white summit of the giant peak above.

A few miles to the south, but easily reached by carriage or by electric car from Colorado Springs, is Cheyenne Cañon, a deep gorge in the foot-hills through which a mountain stream flows. The cañon is narrow and deep and winding, the dark rocks towering hundreds of feet perpendicularly above the path at the bottom. After an hour's walk or ride up through the cañon we reach the foot of the seven falls or the successive springs

of this mountain stream as it comes leaping down the mountain sides to reach the more level bottom of the rocky gorge. The scenery of this cañon is very impressive.

One of the most interesting experiences of this mountain region is an old-fashioned trip on foot or on horseback from Manitou to the summit of Pike's Peak. We secured saddle horses, and set out in the morning about eight o'clock for the twelve-mile journey. Passing the iron spring, from which we drank strength for the journey, we entered the great cañon of the Pike's Peak trail, and followed it for six miles or more. It is a continuation of the vale in which Manitou lies, a crooked, winding valley, rising steadily upward. The mountain sides which formed its borders were sometimes covered with forests of evergreen. Close to the mountain torrent, and sometimes mingled with the pines, were groves of cottonwood. The lower valley was strewn with mighty bowlders, as tall as the tree tops and standing alone, as if some giant hand had hurled them from the mountain tops. The path rose sometimes many feet above the stream, and again ran close by its side, giving great variety of beautiful pictures of this winding valley. The trees, flowers, and grasses were all in the freshness of June. But when we reached the end of this cañon, and turned on our track to climb the rugged backbone of the giant, the scenery was almost entirely changed.

It was too steep to go straight up the slope, so we went up long, slanting paths, along the side of the mountain, round projecting spurs, and at times zigzagging our way, till we were beyond timber-line, eleven thousand feet above the sea. From here on the journey upward was a dismal one, so far as the mountain on which we were climbing was concerned. It was simply a rough, rocky path up a bleak and barren mountain side; but we began now to get magnificent views of mountain ranges and peaks in the distance. Gradually the surrounding summits began to sink beneath our feet, and we could see distant mountain chains a hundred and more miles away. A vast wilderness of mountain scenery opened out toward the west, to the south and north, and now and then we would catch a glimpse of the level plains stretching eastward. It grew cloudy as we ascended, and our view of the mountains was not constant. Before reaching the summit, a passing cloud enveloped us in its chilly folds and we could see nothing. A half mile or more before sighting the top we came upon a wide snowdrift, and leaving our horses we scrambled across the snow and up a rocky path for some distance, and came out upon the broad summit of the mountain, strewn with such big granite bowlders that it was difficult in most places to walk about. The summit house was a low stone structure, with heavy walls to prevent blowing down. For the wind fre-

quently blows at a terrific speed across this summit. They furnished us with hot coffee, and we spent two hours upon the top before starting home again. Fogs or clouds were hanging about the brow of the mountain, and sometimes drifted across its top, and our views from the summit were not full and clear, but we could catch occasional views of Manitou, Colorado Springs, and the eastern plains, and of the mighty wilderness of mountains on the other side. We also walked about the summit, and tried to peer down the great gorges which seam the mountain on two sides.

The rarified air of the mountain top gave some of us a headache, and we were not sorry to start home again. At this time the government kept up a signal station at the top. Two men remained upon the peak, even in winter, and telegraphed daily the weather observations to Colorado Springs. In winter snow and ice were piled up many feet deep about the summit house, and they could not venture out for three months or more. As we descended upon our homeward journey, a heavy storm of rain came up and gave us such a thorough soaking for two hours that we were fully convinced that the rains in Colorado love the mountain slopes. About six o'clock in the evening we rode into Manitou, stiff, hungry, and drenched, and almost completely exhausted after twenty-four miles of mountaineering.

A trip by rail would be doubtless much easier and more comfortable, but a trip on foot or on horseback gives the best opportunities for sight-seeing, and for those who wish to catch the spirit of the mountains, and drink in its rugged strength and health, a foot journey is the opportunity.

Many people spend a month or two among these mountains, climbing the ridges and mountain paths, drinking of the mineral springs, taking in the pure and bracing air of this elevated region, and enjoying the immense variety and grandeur of mountain scenery and life. There are very many other interesting places, deserving a full description, such as the Cave of the Winds, with its labyrinth of caverns and beautiful grottoes. We entered it from a mountain side two or three hundred feet above the bottom of the valley. Monument Park, also, with its host of sculptured forms in rock as nature has chiseled them out, Glen Eyre near the Garden of the Gods, with its chimneyed rocks and grand mountain gorge are much visited. But there is no limit to the attractions of such a wonderland of mountains and valleys. The Colorado Midland Railroad passes up through the valley beyond Manitou, and at Green Mountain Falls, nine miles from Manitou, is a beautiful summer home, 8,000 feet above the sea, with hotels, springs, and a deep valley set in surrounding mountains to protect it from the storms.

In addition to the thirteen topics already given

in full, the following seven topics are simply outlined. The teacher may be able to work these out from cyclopedias, geographical readers, magazine articles, railroad guides, or from other sources. They make the list of twenty topics for fourth grade complete.

1. *Corn and Livestock in Illinois.*

(*a*) Planting and cultivating the corn.
(*b*) Husking, cribbing, and shipping.
(*c*) Fattening stock on corn, and shipping.
(*d*) The stock yards in Chicago.
(*e*) Other grains and farm produce.
(*f*) Comparison of Illinois with neighboring states as a corn and stock producing region.
(*g*) Mills and factories using grain.
(*h*) Railroads and canal for shipping.

2. *Iron Mines of Michigan.*

(*a*) Location of iron region.
(*b*) The mine. Method of getting the ore.
(*c*) Loading and shipping to Chicago, Pittsburgh, etc.
(*d*) Comparison with mines of Wisconsin, Minnesota, and Missouri.

3. *The Blast Furnace. Chicago.*

(*a*) Construction of the blast furnace.
(*b*) Filling up the furnace and the materials.
(*c*) The heating and blast.

(*d*) Drawing off ore.

(*e*) Uses of pig-iron in manufactures.

(*f*) Pittsburg compared with Chicago as a center for pig-iron production.

4. *Chicago as a Trade Center.*

(*a*) Original site.

(*b*) Making a harbor.

(*c*) Great products centering here: Pine lumber, grain, live stock, iron, coal, hard-wood lumber, manufactures.

(*d*) Public works. Water-works. Tunnel. Parks. Exposition. High buildings.

(*e*) Great fire. Losses. Rebuilding.

(*f*) Universities and museums.

(*g*) Manufactures. List of the most important.

(*h*) The canal. Railroads. Shipping on the lake.

(*i*) Comparison with Milwaukee, Duluth, Detroit, Minneapolis, and St. Paul.

5. *Tobacco Raising in Kentucky.*

(*a*) Soil needed. Strength.

(*b*) Cultivating the crop.

(*c*) Cutting and gathering.

(*d*) Curing. Tobacco houses.

(*e*) Louisville as a trade center.

(*f*) Manufacture of tobacco.

(*g*) Compare Kentucky with other states as tobacco producers.

6. *Sugar Plantation in Louisiana.*

(*a*) Raising the cane. Size of fields.
(*b*) Cutting.
(*c*) Crushing in sugar mill.
(*d*) Boiling the sap.
(*e*) Refining.
(*f*) Shipping.
(*g*) Sugar from other sources. Beet root. Maple.

7. *A Cattle Ranch in Texas.*

(*a*) A ranch. Houses, stables. Range.
(*b*) The cowboys. Their skill and hardihood.
(*c*) The round-up. Wild horses.
(*d*) Branding cattle. Loss of cattle. Storms.
(*e*) Shipping to market.
(*f*) The region of cattle ranges.
(*g*) Feeding cattle in the corn belt.
(*h*) Centers for packing business.

CHAPTER III.

Type Studies in Geography.

In devising a plan for geographical study at least two important problems must be met:

1. The selection of a few important representative ideas out of the countless multitude of facts.

2. A method of approach to these ideas which shall instruct and interest the children.

The quantity of geographical knowledge is practically infinite, a hundred times what any child can master. A wise choice of matter is therefore imperative.

A proper study of types offers, we believe, a clear solution of both these problems.

If not more than *twenty topics* are taken up during the year, from one and one-half to two weeks can be spent upon each topic. This is time sufficient to give to each important subject a reasonably exhaustive discussion.

Now, what are the advantages of such a discussion of really important types?

1. A clear and detailed comprehension of a typical object in geography (however small this object may be) is the key to a large area of geographical knowledge. This type, once clearly perceived, is the interpreter of very many similar

objects. A single coal mine, seen in itself and in its relations to the busy world, is an almost perfect type of thousands of coal mines, to say nothing of other mines. A single river or mountain, pictured out in its variety of relations, is a sure exemplar of many others of the same kind. It is to be remembered that we should always select the best types for full study. The study of a type is therefore a short avenue to the interpretation of a large body of knowledge.

2. This detailed study of a type keeps us close to the objects and realities of the workaday world. We are not lost in general statements and abstractions, but are bumping constantly against the varied facts of experience. In other words, there is a powerful realism in this kind of study which gives a healthy tonic effect. The worst criticism that can be brought to bear upon our present teaching of geography, is that it is abstract and unreal. It is formal and dry. We are not to forget, however, that, while such a type is very real and concrete, it contains a general truth of wide application. This general nature of the type, and the extent of its application, should be seen before the discussion is dropped. Skill in teaching nearly every subject depends upon the teacher's power to show the relation between the general truths of a subject and its particular objects and facts. The *type* is the true mediator between these two extremes.

3. It need scarcely be said that a full treatment of a topic like the pineries or the coal mine, is thoroughly instructive and interesting to children. It satisfies a true thirst for knowledge. It explains a hundred facts they are anxious to know about. Instead of giving them a few barren statements to memorize, it responds to a child's inquiries with a liberal supply of nourishing and palatable information.

4. The study of causes and causal relations.

One of the chief reasons why children are interested in such a study of a type is, that it is, at every step, a study of causes. Children are often concerned about facts, but they are still more inquisitive about causes. Unless their schooling has been very bad, they are strongly inclined to reason out the causal relations. In the study of the pineries, for example, every step in the process of lumbering from the skidding of the logs in the forest to the unloading of lumber on the western prairies is an adaptation of labor, skill, and machinery to the physical conditions imposed by surface, climate, rivers, prairies, etc., a tracing of cause and effect. It is a fine thing for children to see this application of labor and skill and to have their interest strongly awakened in many forms of human endeavor. We should realize, however, that causal relations can not be clearly seen unless a topic is treated with fullness. Our geographies give us a few barren, meager facts,

too much stripped of detail to show their relations. By means of the more exhaustive treatment of a typical subject, we see it in its varied causal relations, we perceive the modifying or controlling influences which determine its character. In each of the examples given, Illinois River, Coal Mine, Prairies, Pineries, etc., the links which connect different topics together are welded by a perception of causal relations. But what is true of these topics is true of every typical subject which is delineated with sufficient fullness to reveal the true causal sequences. This is the point at which outlines or brief epitomes utterly fail. They may state important facts, but they cannot reveal the causal nexus. It is necessary to enter upon the deeper details in order to catch a glimpse of working causes.

But this more penetrating study into a topic brings us in close contact with other branches of knowledge, and so we come to see the importance of the relations of geography to other studies. A full investigation of a coal mine, for example, shows plainly how the roots of geography are intertwined with the roots of other sciences. Children are almost certain to ask how coal came to be stored in the earth, a question which leads back into the history of the earth's crust, into atmospheric and climatic conditions, into plant life and to great physical and chemical changes. The use of powder and other explosive materials in blast-

ing, the collection and explosion of gases in mines, the safety-lamp and mine ventilation, the steam engines, pumps, and ventilating fans, the combustion of coal, the production of coal gas, etc., are topics that belong to physics, chemistry, and practical mechanics. So many and intimate are the linkings with other studies that the chief danger of such an exhaustive treatment of a coal mine is that both teacher and class may be switched off the main geographical track, and get lost in the history of geological changes, in the chemical composition of coal, in the physics and chemistry of the atmosphere and of explosives or in some other purely scientific topic. The only safety is to grasp firmly the main outlines of the geographical subject and to treat all these other sciences, however intimate, as tributary. So far as they directly explain geographical facts they should be drawn upon.

To further illustrate the significance of these causal relations of geographical topics to each other, and to the natural sciences, suppose we give a full description to Pike's Peak and vicinity, including the vale of Manitou, the mineral springs, the Garden of the Gods, Cheyenne Cañon and Falls, the caves, the trail to the Peak, the views of distant mountains, the snow line, the rock-strewn summit, the vegetation, winds, air-pressure, the stratified and igneous rocks, the gorges and mountain torrents, the surrounding

mountain groups, the railroad to the summit, the peak in winter, etc. Such a particularized study of a geographical type not only brings out a closely-related body of representative geographical ideas, causally bound together, but it plunges us deep among the roots of the other sciences upon which geography rests, *e. g.*, geologic strata and changes, the physics of air pressure, vegetation, and animal life in mountain districts; the chemistry of mineral waters, railroad engineering in mountain cañons; winds, snows and meteorology, erosion by ice and water. In the midst of such a region nature also shows herself beautiful and refreshing, or grand and rugged for the culture of the esthetic and religious sense. What does the usual study of geography give us to treasure up from such a region? Ought not a detailed and instructive description of such a type, aided by pictures, give us a score of attractive views into the very workshop of nature? From the rock-strewn summit of Pike's Peak to the health-giving springs that gush from its roots at Manitou, this whole region is bathed in science as in sunlight. Yet our purpose is not to teach natural science, but geography, as causally based upon natural science.

True insight into any topic, and appreciation of its value, are based chiefly upon the causal chains which link it to other kinds of knowledge.

5. A type-subject is the basis of a series of

comparisons. The representative or type idea which it illustrates appears again and again in a multitude of kindred objects. A full graphic account of the Illinois River from its source to its mouth is found, by later comparisons, to be a pretty fair description of a score of other rivers in the United States. In the same way the logging industry in one camp and along one stream is representative of such camps throughout the whole of the pineries.

If, therefore, we are careful to select good types and then, after treating them fully, to make sufficient comparisons to show the modifications of the type in different localities, we shall gain speedily an instructive insight into large areas of geographical knowledge. The original type-subject becomes then a standard of measurement for the multitude of similar subjects that are sure to come up. Such a clear type is an interpreter and a test of each kindred subject the moment it appears. The extension of a typical idea by means of comparisons is a good opportunity for the children to think and to reason for themselves. If it is a study of rivers, to examine the map and to interpret the slopes and structure, commerce and cities.

Comparisons on the basis of fully developed types are the best means of *review*. Reviews by means of comparing old with new topics are a vigorous and stimulating exercise. They throw

new light on the old facts, they interpret the new. They group and consolidate geographical topics and develop the power to classify and organize knowledge.

6. *From Home Outwards.*—This movement from home outwards, on the stepping-stones of great typical subjects, is quite in contrast to the usual analytic treatment of geography in text-books and in class-rooms. The chief objection to our plan seems to be that it is a somewhat blind movement into an unknown world, and that it takes too little notice, at the start, of the great physical and structural features upon which geographical insight chiefly depends. Rivers, slopes, products, climate, and industries depend upon these great structural ideas of physical and mathematical geography.

It is not our intention to neglect these things nor to undervalue their importance, but to get at them by a different approach. In beginning geography in fourth grade, we wish to get at it in a more tangible, realistic, and picturesque manner. A whole continent does not seem to us a suitable subject for detailed treatment in fourth grade. In spite of sand-building and modeling it remains largely a formal and barren subject. Short surveys of the whole world and a somewhat fuller treatment of North America may well preface the series of typical studies we have outlined. But they should be brief and preliminary, merely a

bird's-eye view. By a constant use of wall maps of the United States and of North America, by means of the broader comparisons and surveys which close up the treatment of every typical subject, we are steadily marching toward a clear and definite understanding of the great physical features of the Mississippi Valley and of North America. The characteristic regions of production are brought out with great distinctness, and when we finally reach the point where the Mississippi valley as a whole can be surveyed, how rich and varied do its resources appear! What variety of surface, landscape, and climate! How closely connected by water and rail! The whole Mississippi Valley finally becomes the type of a mighty river basin, with which the proudest and most fruitful river basins of the world may be later compared.

7. To what extent does the series of types, which we have outlined, cover the whole field of geographical studies for these grades? Only a few topics are fully treated and many important facts may appear to be neglected. How far will the product of such a year's study be complete and systematic rather than fragmentary and disconnected? It is not claimed that the treatment of single types will give fullness and completeness to these studies, but only that the series of types furnishes a safe central line of operations. To supplement and complete the work with types we

shall need map studies and map drawings, comprehensive surveys, reviews, and drills, and abundant use of text-books and wall maps. The formation of important and significant series of geographical objects will bind together the larger units as well as the smaller. For example, the great commercial routes of the Mississippi valley from east to west, and from north to south, the climatic zones, the large river valleys and mountain chains will bind together the separate facts into larger series and complexes.

But the type studies themselves, if followed out, will lead to an organic building up of large geographical groups and sequences. The study of Pike's Peak and the neighboring mountain cluster, when compared with Gray's, Fremont's, and the Spanish peaks, leads on to a knowledge of the main ridge of the Rocky mountains of which they are striking parts. The study of Lake Superior leads to an understanding of the series of great lakes and of this important line of water traffic between the east and west. The description of the hardwood forests of Indiana is incomplete till the whole extensive Ohio valley, with the tributary streams, is drawn in. The very idea of a type study involves the necessity of reaching out so as to embrace a large number of kindred objects into one connected series or group. If we have succeeded in selecting the important types of the Mississippi Valley, a proper comparison

and extension of these types will draw in most of the cities, rivers, lakes, mountains, etc., that deserve a child's attention. If any are left out, it is because they are not important or characteristic enough to demand notice. We are disposed to omit all geographical names which have nothing in particular to recommend them, nothing which they help to illustrate or explain. A great many geographical objects are of local importance, of which a child, for the present, can afford to remain entirely ignorant.

Our further plan is to follow in fifth grade a series of type studies through the Atlantic and Pacific States, British America and Mexico, closing fifth grade work with a conclusive survey of North America as a whole. North America then becomes our type of a continent with which we may set out to measure more accurately the other continents of the world. Our general movement, is toward ever larger and more complex wholes. It is, in the main, synthetic.

CHAPTER IV.

METHOD OF CLASS-ROOM WORK.

The method of treating types in class-room instruction is discussed more fully in the book on "Method in the Recitation," but its particular application to the elementary geography will be in place in closing up our discussion of Special Method in this subject.

Our plan of work for third and fourth grades, as suggested in the foregoing pages, is essentially a method for oral instruction. This is necessarily so in the home geography of the third grade, and is equally involved in our type studies of the fourth grade. What method of instruction should be adopted in fourth grade so that children will get a clear and adequate understanding of a coal mine or of Lake Superior, or of the lower Mississippi? We are not in favor of putting a book in the hands of children at this age, although the maps, pictures, and printed matter in a good book may be helpful. The teacher is more important in such work than any text-book. Let him handle and present, and discuss the subject with the children. This involves a good share of the art of teaching. It implies a mastery of the subject, an understanding of the children and

a practical acquaintance with the technique of instruction, such as discipline, narrative power, graphic representation on blackboard, thoroughness, and drill. The effort to acquire skill in this kind of oral treatment and discussion of topics is well worthy the ambition of earnest teachers. It is not a thing of easy attainment, and yet, if successful, it gives uncommon zest and spirit to the teacher's work. We will attempt to indicate some of the imperatives which the teacher must lay upon himself if he seeks success along this line of effort. We may remark in passing that many teachers are inclined to look upon all definite requirements as limitations to their freedom and individuality. But thoughtful teachers are seeking for definite channels along which to work out their freedom and individuality. They are even willing to submit to laws if they lead to success and to a better regulated activity.

For teachers who are seeking skill and mastery in the oral treatment of topics we will suggest the following points:

1. Each topic or type should be grasped as a whole. The type idea which the particular illustration exemplifies should stand out clearly in mind. This requirement is a preliminary and preparation of good teaching rather than a part of it. The type idea may not come out at all for a while in the instruction of children, but it stands in the background of the teacher's mind all the

while and regulates his progress. This central idea or line of thought is the pivot upon which the whole discussion hinges. It gives the teacher a true perspective in the treatment of his subject, it tells how much or how little detail is needed in special topics, and how far it is safe to trace the relations to other subjects and into other studies. In short, the type idea gives the teacher a safe center of operations.

2. Each topic or subordinate part of the larger whole should stand out clear and sharp. Its distinctness should not be blurred by its close relation to other topics. The whole series of related topics, constituting a larger whole, should be worked out beforehand by the teacher and afterwards with the children, so that they not only master the ideas but fall into logical habits of thinking and learning.

3. We deem it well for both teacher and taught to preserve a neat copy of this outline of topics from day to day through the year. It is a standing proof of systematic and careful progress, and a good basis for reviews. It will be serviceable in language compositions, and the outlines of other oral recitations in literature or history, in natural science and in language, should be neatly preserved in the same book.

4. In order to acquire the power of clear and vivid presentation of topics, the teacher must exercise himself in a variety of ways. He must train

his own imagination to picture out geographical scenes and objects with great clearness. A constant appeal to the constructive imagination of children is necessary, or they will deceive both themselves and the teacher with words and phrases where distinct images and clearly defined pictures are absent. In this work of stimulating original thought power in children, the teacher needs all the devices of graphic illustration, whether it be word picturing, black-board diagram, comparison with homely and familiar objects, appeal to the children's experience and observation, sand modeling, the skillful use of pictures or even drawing pictures, gesture, and facial expression. Of course the art of plain and simple description and narrative is to be cultivated. It is one of the prime elements in the teaching art.

5. It is one thing for the teacher to do his duty in oral lessons and another to get children to do theirs. In good oral teaching at least half the burden of work must be carried by the children. This again calls for a variety of skill and device. In the midst of the presentation and discussion of a topic children need to be pointedly and skillfully questioned from time to time so as to be thrown back upon their own resources, to make use of previous experience and to think and judge correctly. Such questions force children to self-activity and original thought. When a topic has

been properly presented and discussed it falls to the children to reproduce it with reasonable fullness and accuracy. In this respect it is the teacher's function to hold the children to a strict performance of duty, else oral instruction will degenerate. When the children find that this requirement is unavoidable and sure they will be prepared for the effort. It will also take away from the teacher the danger of talking too much. In oral instruction class attention is almost an absolute requirement. Not only is a strong control desirable but close watchfulness to detect inattention, readiness to throw out a question or hint, to call back the wandering thought. Variety of tests may also be employed, brief written tests, board work, map drawing, as well as oral reproduction.

6. In the third and fourth grades, where children are getting their introduction to geographical ideas, an oral treatment is particularly in place because it is so concrete and real, so graphic and interesting. The teacher who is trying to make a success of oral teaching will naturally resort to graphic methods of presentation, black-board diagrams, pictures, and descriptive details, which prove so instructive and full of meaning. In later years, when children have collected a larger quantity of illustrative material and have learned to think along more general and abstract lines, they may study from books and deal with laws and

principles. But in these early years the more objective method, with oral presentation, discussion, and reproduction, is better adapted to children, and to the development of skill and mastery in the teacher.

7. The teacher who will learn to teach geography well along the line of excellence which we have suggested, will also teach reading, arithmetic, and grammar better. Even with a text book in his hand he will do better, because he will seek to illustrate and bring out what the text states in such brief or abstract form. In other words, he will catch the spirit of a right pedagogical method.

We are not ignorant of the fact that many practical difficulties in schools militate against the successful execution of such a plan as we have outlined. Text books, courses of study, daily programs, the presence of two or more classes, etc., are not in harmony with this plan. But while it will need to be modified in adapting it to most schools, it is still true that our text books and courses of study need to be supplemented and improved by such a method of oral instruction.

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